SEPA Environmental Checklist

Tacoma Trestle Track & Signal Project

July 2014

Prepared for:

Sound Transit
Union Station
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Prepared by:

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Environmental Checklist

A. Background

1. **Name of the proposed project, if applicable:**

   Tacoma Trestle Track & Signal Project

2. **Name of applicant:**

   Central Puget Sound Regional Transit Authority (Sound Transit)

3. **Address and phone number of applicant and contact person:**

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4. **Date checklist prepared:**

   July 2014

5. **Agency requesting checklist:**

   Sound Transit is the lead agency under the State Environmental Policy Act (SEPA).

6. **Proposed timing or schedule (including phasing, if applicable):**

   Final design is expected to occur between fall 2014 and spring 2015. Construction is proposed to begin in fall 2015 and is expected to be completed in fall 2017.

7. **Do you have any plans for future additions, expansion, or further activity related to or connected with this proposal? If yes, explain.**

   Sound Transit does not have any future additions, expansion, or furtheractivity related to or connected with this approval. Other projects in the area are described below under Question 9.

8. **List any environmental information you know about that has been prepared, or will be prepared, directly related to this proposal.**

   Environmental documentation that has been prepared:

   - Section 106 Memorandum of Agreement among the Federal Transit Administration (FTA), Washington State Historic Preservation Officer, and the Central Puget Sound Regional Transit Authority, April 2014
   - Documented Categorical Exclusion, Sound Transit, April 2014 (approved by FTA)
   - Endangered Species Act Screening Checklist, Sound Transit, October 29, 2013 (approved by FTA)
   - Section 4(f) Evaluation, Sound Transit, February 2014 (approved by FTA)
   - WSDOT/Federal Railroad Administration (FRA) Pacific Northwest Rail Corridor Washington Segment – Columbia River to the Canadian Border Tier-1 EA/FONSI, 2009 and 2010

- Commuter Rail Facility at Tacoma Dome Station Environmental Assessment, Sound Transit, April 1999

9. **Do you know whether applications are pending for governmental approvals of other proposals directly affecting the property covered by your proposal? If yes, explain.**

   A portion of the WSDOT Point Defiance Bypass project is located in the same area as the Tacoma Trestle Track & Signal Project. The Point Definance Bypass project relocates Amtrak Cascades and Coast Starlight service to Sound Transit's rail coordior, which includes the Tacoma Trestle, by 2017. The Point Defiance Bypass project also includes construction of a station and extension of a platform at Freighthouse Square. WSDOT and the Federal Railroad Administration (FRA) prepared an Environmental Assessment for the Point Definace Bypass project in February 2013. The EA analyzed several areas including noise and traffic. FRA issued a Finding of No Signficant Impact (FONSI) in February 2013.

   The 2014 EA included extending the existing platform at Freighthouse Square located at the west end of the existing trestle westward across East C and East D Streets. WSDOT is now considering accommodating the Amtrak operations with an approximately 650-foot-long eastward extension of the existing platform. This, in turn, will minimize impacts by the two daily Amtrak Coast Starlight trains by eliminating the blockage of East D and East C Street during stations stops. If it proceeds, the eastword platform extension will likely be constructed simultaneously with the Tacoma Trestle Track & Signal Project. However, the platform extension has independent utility from the Tacoma Trestle Track & Signal Project, and environmental review and approval for the platform extension is being conducted independently by WSDOT.

10. **List any government approvals or permits that will be needed for your proposal, if known.**

    - National Pollutant Discharge Elimination System (NPDES) Construction Stormwater General Permit, Washington State Department of Ecology
    - Grading and Excavation Permit, City of Tacoma
    - Critical Areas Permit, City of Tacoma
    - Wetland Development Permit, City of Tacoma
    - Right-of-Way Permit, City of Tacoma
    - Building and Demolition Permits, City of Tacoma

11. **Give brief, complete description of your proposal, including the proposed uses and the size of the project and site. There are several questions later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page. (Lead agencies may modify this form to include additional specific information on project description.)**

    The Tacoma Trestle Track & Signal Project will replace a single-track wooden trestle within an approximately 0.65-mile section of the Sounder Commuter Rail/Amtrak corridor with a double-track bridge structure, plus related track and railroad signal improvements. Currently, the Tacoma Trestle is a bottleneck for both passenger rail and freight rail. The new bridge would be built to industry (American Railway Engineering and Maintenance of Way Association [AREMA]) standards and would allow passenger trains to safely cross at speeds of at least 30 mph. The new and expanded bridge structure would reduce congestion and delay for current passenger service and freight trains as well as for previously planned expansion of passenger rail service under the WSDOT Point Defiance Bypass project, Sound Transit Sounder Seattle-to-Tacoma

Commuter Rail Easements and Improvements (Easements 1 and 2), and Sound Transit Sounder Seattle-to-Tacoma Commuter Rail Easements and Improvements (Easements 3 and 4). The Tacoma Trestle Track & Signal Project would not increase the number of trains beyond existing service and the previously planned expansion described above.

Specific elements of the proposed project include demolition and removal of the existing single track trestle, upgrades to the embankment along the trestle approaches, construction of a double- track bridge structure with tracks and crossovers, signal upgrades, and erosion control. Additional earthen fill and retaining wall structures will be required for construction of the new bridge structure. The project would also likely require changes to railroad signals and control points near the trestle. In addition, some underground utilities, such as sanitary sewer and fiber optic communications lines, will likely be relocated to allow for the wider two-track bridge structure. Construction staging areas would also be required to provide equipment storage and stockpiling.

12. **Location of proposal. Give sufficient information for a person to understand the precise location of your proposed project, including a street address, if any, and section, township, and range, if known. If a proposal would occur over a range of area, provide the range or boundaries of the site(s). Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available. While you should submit any plans required by the agency, you are not required to duplicate maps or detailed plans submitted with any permit applications related to this checklist.**

    The project is generally located from Freighthouse Square (near East F Street) to East M Street between East 25th Street and East 26th Street in the City of Tacoma, Pierce County, Washington (Figure 1). The project is in the City of Tacoma's Tacoma Dome District and adjacent to the Tacoma Dome Station, a multi-modal transit facility serving Sounder commuter rail, Tacoma Link light rail, and Greyhound local and express bus lines. The project site is located in Sections 10 and 37 of Township 20 North, Range 3 East.

B. Environmental Elements

1. Earth

a. **General description of the site (underline one):**
Flat, rolling, hilly, steep slopes, mountainous, other

The site is generally flat with a gentle slope downward to the north and west, toward Commencement Bay.

b. What is the steepest slope on the site (approximate % slope)?

The steepest slope on the site is approximately 55 percent at the track embankment approaching the existing trestle.

c. What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, please specify and note any agricultural land of long-term commercial significance and whether the proposal results in removing any of these soils.

The project site generally consists of fill overlying estuarine and beach (non-glacial) deposits, overlying fluvial and lacustrine deposits (glacially overridden material). Soil types include Continental Glacial Drift (Pleistocene), Continental Glacial Drift pre-Fraser (Pleistocene), Continental Sedimentary Deposits (Pleistocene), and Artificial Fill (Holocene) (S&W 2014a). No agricultural soils are located within the project area.

d. Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.

A liquefaction analysis conducted for soils within the project area indicate that the site is potentially liquefiable (S&W 2014a). Portions of the site (near the west bridge abutment) are also considered susceptible to lateral spreading in a seismic event.

e. Describe the purposes, type, total area, and approximate quantities and total affected area of any filling, excavation, and grading proposed. Indicate source of fill.

The project will require a minimal amount of clearing and grading for staging and the construction of minor project elements and the placement of fill material during construction necessary to expand the trestle approaches. Approximately 1.5 acres of total area will be affected by filling and excavation. Approximately 12,000 cubic yards of excavation will be required to remove the existing trestle structure, relocate utilities, and install the proposed stormwater system (DEA 2014). Between 10,000 and 20,000 cubic yards of fill is anticipated to construct the new embankments, backfill abutments, and cover foundations. The source of fill material will be determined by the construction contractor from an approved source.

f. Could erosion occur as a result of clearing, construction, or use? If so, generally describe.

The potential for soil erosion during construction is very low because of the generally flat conditions on the project site and nature of the construction practices involving stabilized material. Exposed soils, including both on the site and in construction staging areas, could lead to erosion and subsequent sedimentation of storm drains and downstream water bodies if not properly controlled.

g. About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?

Approximately 20 percent (1.0 acre) of the existing project area is covered by impervious surfaces. As part of the proposed project, areas of new impervious surface would be added as part of the widened bridge deck, new gravel areas, and bridge approaches. Upon project completion, approximately 47 percent (2.3 acres) of the project area will be covered with impervious surfaces.

h. Proposed measures to reduce or control erosion, or other impacts to the earth, if any:

Design measures to address hazards associated with liquefaction and lateral spreading susceptibility will be developed during the preliminary engineering phase. These may include soil improvement techniques or modification of the structural design to accommodate loads resulting from liquefaction-inducted settlement and lateral spreading (S&W 2014a).

A Temporary Erosion and Sediment Control (TESC) Plan and Stormwater Pollution Prevention Plan (SWPPP) will be prepared to control erosion during construction, in accordance with NPDES requirements. Construction Best Management Practices (BMPs) will be implemented as part of these plans to reduce or control erosion and water quality impacts during construction. Potential BMPs include use of stabilized construction entrances, silt fencing, sediment traps, and application of seeding or mulching for soil stabilization. Areas disturbed during construction will also be revegetated as soon as possible.

2. Air

a. What types of emissions to the air would result from the proposal during construction, operation, and maintenance when the project is completed? If any, generally describe and give approximate quantities known.

Project construction would result in temporary air quality impacts from fugitive dust and emissions from construction equipment and vehicles, such as on-track rail equipment, dump trucks, bulldozers, excavators, graders, compactors (rollers), crane, and an impact pile driver. However, these impacts would be intermittent and temporary and are not expected to degrade local air quality in the long term.

When completed, the proposed project will not increase rail or vehicular traffic, cause traffic congestion, or increase emissions from any source. Therefore, there would be no adverse air quality impacts associated with the new bridge structure. Rail traffic would move more quickly through the project area, which is expected to reduce idling time and therefore reduce pollutant emissions to the air.

b. Are there any off-site sources of emissions or odor, which may affect your proposal? If so, generally describe.

There are no off-site sources of emissions or odor that may affect the proposed project.

c. Proposed measures to reduce or control emissions or other impacts to air, if any:

The following measures would be used to reduce or control air quality impacts during construction:

- The construction contractor will be required to comply with all relevant air quality laws.
- Appropriate BMPs will be employed to reduce air pollutant emissions and dust during grading, demolition, and construction activities. These would typically include applying water during dry periods to control fugitive dust.

3. Water

a. Surface Water

1) Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.

Three wetlands and one jurisdictional ditch totaling approximately 0.3 acre have been identified and delineated within the project area. An approximately 5,300-square-foot Category IV wetland (Wetland 1) is located below the Tacoma Trestle at the west end. The wetland is degraded and contains barrels, trash, and creosoted logs. Little vegetation is present due to the presence of creosote and likely regular weed control. A second Category IV wetland (Wetland 3) is located under the trestle just west of Wetland 1. Wetland 3 is very small (approximately 60 square feet) and is separated from Wetland 1 by fill material that provides support to the trestle's log frames.

An approximately 4,400-square-foot Category IV wetland (Wetland 2) is located at the western end of the project on private property north of East 26th Street. An approximately 3,600-square-foot ditch is located between East K Street and East M Street. The ditch lies at the toe of a steep cut slope to the south and the track's gravel ballast shoulder to the north.

2) Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.

It is anticipated that Wetlands 1 and 3 will be permanently impacted by the placement of fill material in order to construct the new double-track bridge structure. Direct impacts to Wetland 2 or its buffer are anticipated only in the event that the construction contractor identifies the property as a staging location. Direct permanent impacts to the ditch are anticipated by moving the track that is currently adjacent to the ditch into the ditch and recreating its function slightly to the south. Plans illustrating the proposed improvements in relation to each wetland are provided in Attachment A.

3**) Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.**

Due to the location of Wetlands 1 and 3 directly below the existing Tacoma Trestle and directly adjacent to the existing track, it is anticipated that the entire area of these wetlands will be directly impacted by the fill placement. This includes approximately 5,375 square feet of total direct impact to wetlands.

4) Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities if known.

The proposed project would not require surface water withdrawals or diversions.

5) Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

Per the City's Flood Hazard Areas Map (City of Tacoma 2008), the project site is not located within the 100-year floodplain.

6) **Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.**

No waste materials would be discharged to surface waters from construction or operation of the proposed project.

b. Ground Water

1) **Will ground water be withdrawn from a well for drinking water or other purposes? If so, give a general description of the well, proposed uses, and approximate quantities withdrawn from the well. Will water be discharged to ground water? Give general description, purpose, and approximate quantities if known.**

High artesian groundwater pressures are present at the project site (DEA 2014). The groundwater table is present at ground level to 4 feet below ground level. Dewatering of groundwater may be required during construction for the installation of up to three buried foundations at the East 26th Street/East G Street Crossing. Dewatering may also be required to construct the bridge foundations and to accommodate the proposed utility relocations.

2) **Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (for example: Domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.**

No waste material would be discharged into the ground from construction or operation of the proposed project.

c. Water Runoff

1) Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.

The primary source of runoff is from stormwater during construction and operation. To prevent sediment from traveling beyond the work zone during construction, BMPs would be utilized specific to this project and location. These BMPs include such measures as stabilized construction entrances, silt fencing, and sediment traps. A TESC Plan and SWPPP would be required to prevent sediment transport from the project area to nearby water bodies.

The amount of runoff following construction would not be substantially different from that prior to construction due to the minimal change in runoff characteristics of the construction area and materials. Stormwater runoff from the Tacoma Rail right-of-way enters drains connected to the City of Tacoma storm drainage systems. Stormwater treatment is not currently provided within the project area.

The proposed stormwater drainage system will consist of bridge scuppers to collect stormwater from the bridge and downspouts that will convey stormwater to the base of the structure to a trunk line running parallel to the bridge (DEA 2014). The most likely point of connection to the City stormwater system is at an existing storm sewer manhole within J Street. Stormwater treatment (if required) will be provided by treatment vaults or equivalent which will be installed at the end of the trestle storm sewer line immediately before discharging into a City storm sewer manhole.

2) Could waste materials enter ground or surface waters? If so, generally describe.

No waste materials are expected to enter ground or surface waters.

3) Does the proposal alter or otherwise affect drainage patterns in the vicinity of the site? If so, describe.

No streams or drainageways will be affected by the proposed project. Current ditches and drainage collection patterns will be maintained.

d. Proposed measures to reduce or control surface, ground, runoff water, and drainage pattern impacts, if any:

It is anticipated that direct impacts to Wetland 2 can be avoided. Direct impacts to regulated wetlands (Wetland 1) will be mitigated in compliance with applicable federal, state, and local regulations. Wetland mitigation would consist of creation or restoration of wetlands either on or off- site, or on or off-site wetland enhancement.

Depth to groundwater will be measured during the preliminary engineering phase to further evaluate the potential for stormwater infiltration on the project site. Stormwater treatment options will also be evaluated during preliminary engineering which would further improve water quality on-site. These options could include a combination of treatment vaults and vegetated treatment facilities depending upon final design options.

Construction BMPs such as use of stabilized construction entrances, silt fencing, sediment traps, application of seeding or mulching for soil stabilization, or other techniques will be implemented as necessary in accordance with requirements of the NPDES permit for construction to reduce or control water quality impacts.

4. Plants

a. Check the types of vegetation found on the site:

- __X__ deciduous tree: alder, maple, aspen, other (see below)
  __X__ evergreen tree: fir, cedar, pine, other
  ____ shrubs
  __X__ grass
  ____ pasture
  ____ crop or grain
  ____ orchards, vineyards, or other permanent crops
  __X__ wet soil plants: cattail, buttercup, bulrush, skunk cabbage, other: horsetail, bluegrass
  ____ water plants: water lily, eelgrass, milfoil, other
  ____ other types of vegetation

The project site is located in an industrial area and has little vegetation other than grasses and invasive weeds. Vegetation includes grasses, weeds, blackberry, and patches of small trees. The area at the southeast end of the trestle within the City of Tacoma's East K Street right-of-way is comprised of almost exclusively Himalayan blackberries. There are 37 trees growing within the potential construction staging areas, including bigleaf maple, red alder, black cottonwood, arborvitae, red maple, sweetgum, Douglas-fir, and London plane tree (WFCI 2014).

b. What kind and amount of vegetation will be removed or altered?

Up to three acres of property will be impacted by temporary construction easements (DEA 2014). This area represents the worst-case scenario for vegetation removal. This area is heavily disturbed and includes grasses, invasive weeds, and approximately 37 trees that may be removed during construction. The trees range in size from 5 to 22 inches in diameter, and 10 of the trees were determined by an arborist to be poor condition.

c. List threatened and endangered species known to be on or near the site.

None known to be on or near the site.

d. Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:

Landscaping plans will be developed during final design. Tree removal will be minimized to the extent possible. Tree replacements will be determined in consultation with Sound Transit Operations to ensure that new trees will not impact safety of commuter, intercity passenger, and freight train operations. BMPs will be implemented during construction to minimize general vegetation removal. Disturbed areas will be revegetated as soon as practical.

e. List all noxious weeds and invasive species known to be on or near the site.

A wide variety of nonnative and invasive plant species have been observed on the site, including Himalayan blackberry, reed canarygrass, Canada thistle, and English ivy.

5. Animals

a. List any birds and other animals which have been observed on or near the site or are known to be on or near the site. Examples include:

birds: hawk, heron, eagle, songbirds, other: see below
mammals: deer, bear, elk, beaver, other: see below
fish: bass, salmon, trout, herring, shellfish, other ___

Only animals tolerant of high levels of human activity occur in the project vicinity, including common urban birds such as crow, robin, house sparrow, and seagulls. Some birds of prey such as red-tailed hawk, osprey or bald eagle may fly over the project area during daily foraging flights. Small mammals such as opossum, Norway rat and mice may occur in remnant patches of habitat.

b. List any threatened and endangered species known to be on or near the site.

Listed endangered, threatened, and candidate species that potentially occur in the vicinity of the project site include Puget Sound Evolutionarily Significant Unit Chinook salmon and their Critical Habitat, Puget Sound Distinct Population Segment (DPS) steelhead, and Puget Sound DPS bull trout and their Critical Habitat (Sound Transit 2013). The project site does not occur within 150 feet of water bodies that support listed species, and the project site and vicinity do not provide any habitat that would support listed species.

c. Is the site part of a migration route: If so, explain.

Yes. The entire Puget Sound area is part of the Pacific Flyway for migratory birds.

d. Proposed measures to preserve or enhance wildlife, if any:

Since the project would have minimal impact to wildlife habitat, including habitat of threatened or endangered species, no measures to preserve or enhance wildlife are proposed.

e. List any invasive animal species known to be on or near the site.

None known.

6. None are known. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

Electricity will be utilized to power two track signals at the east end of the new bridge structure and two track signals at the west end of the new bridge structure.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe.

The proposed project would not affect the use of solar energy by any adjacent properties.

c. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:

The proposed project will contribute to the reliability and efficiency of the commuter rail system.

7. Environmental Health

a. **Are there any environmental health hazards, exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that occur as a result of this proposal? If so, describe**.

There is potential to encounter near-surface soil or groundwater contamination from the Asarco copper smelter (metals), historic railroad use, or contaminated groundwater

migrating on-site from off-site sources. Geotechnical borings conducted during the conceptual engineering phase of the Tacoma Trestle Track & Signal Project indicate the presence of minor surface or near-surface contamination by petroleum, metals, and/or polynuclear aromatic hydrocarbons (PAHs) within the project area (S&W 2014b). It is anticipated that these contaminants will be encountered during future construction activities. No soil encountered during the investigations was characterized as Dangerous Waste.

The project contractor for the track improvements may have small amounts of oil, hydraulic fluid, construction adhesives, cleaning solvents, and similar chemical compounds that would be used or applied on-site during construction. Other than these temporary construction uses, there would be no hazardous materials stored on-site.

1) **Describe any known or possible contamination at the site from present or past uses.**

   See description above.

2) **Describe existing hazardous chemicals/conditions that might affect project development and design. This includes underground hazardous liquid and gas transmission pipelines located within the project area and in the vicinity.**

   See description above.

3) **Describe any toxic or hazardous chemicals that might be stored, used, or produced during the project's development or construction, or at any time during the operating life of the project.**

   See description above.

4) **Describe special emergency services that might be required.**

   No special emergency services would be required during construction or to support the new bridge structure. Sound Transit has an existing safety plan for its operations that includes coordination with local emergency response agencies in the event of an emergency during operation of the trains. Sound Transit's safety plan complies with Federal Railroad Safety Board standards. Where the alley vacation for the project would affect adjacent properties, Sound Transit would coordinate with property owners regarding emergency access.

5) **Proposed measures to reduce or control environmental health hazards, if any:**

   Additional sampling during Preliminary Engineering will be completed to further characterize the extent of contamination and disposal methods (S&W 2014b). A plan will be developed for removal, treatment, or disposal of any contaminated soil or groundwater encountered during construction. Any such occurrence would be managed using standard approaches in accordance with applicable requirements.

b. Noise

1) **What types of noise exist in the area which may affect your project (for example: traffic, equipment, operation, other)?**

   Existing noise sources near the proposed project include existing trains, traffic on Interstate 5 and local streets, local businesses, and events held at the Tacoma Dome. As part of the existing rail service, trains sound horns in the area of the East C Street and East D Street at-grade crossings located near the project per federal regulations. There are nine noise sensitive receptors (single-family residences and hotel rooms) within 500 feet of the project area (see the Noise and Vibration Technical

Memorandum in Attachment B). There are no schools, hospitals, parks, or other sensitive receptors in the immediate area that would be impacted by construction or operational noise. Existing noise in the area would not affect the proposed project.

2) What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.

During construction, there would be temporary increases in sound levels near construction areas. Typical construction equipment could include bulldozers, graders, pavers, haul trucks, and other similar machinery. The loudest construction noise source is likely to be impact pile drivers, which will be used to drive support piles for the new trestle into stiff lower sand and/or till soil layers. Impact pile drivers typically produce in-air noise levels of approximately 110 decibels. The project would comply with applicable state and local noise requirements.

The completed project will allow increased train speeds from 10 mph to a maximum of 35 mph and may also relocate an existing track crossover (see Attachment B). While the project will not increase the number of trains, 18 additional daytime trains and 4 nighttime trains will utilize the trestle by the year 2017. The increase in the number of trains is part of previously approved plans (WSDOT Point Defiance Bypass Project, Sound Transit Sounder Seattle-to-Tacoma Commuter Rail Easments and Improvements [Easements 1 and 2], and Sound Transit Seattle-to-Tacoma Commuter Rail Easments and Improvements [Easements 3 and 4])and will occur even if the Tacoma Trestle Track & Signal Project is not constructed.

The noise analysis indicates that based upon existing ambient noise levels and cumulative noise levels, the project will not create noise levels at sensitive receivers that exceed the FTA noise criteria and all sensitive land uses within the project area will be below the FTA vibration criteria. No operational noise or vibration impacts are predicted.

3) Proposed measures to reduce or control noise impacts, if any:

Construction activities will comply with applicable state and city noise standards, which limit night-time and weekend noise levels from construction.

8. Land and Shoreline Use

a. What is the current use of the site and adjacent properties? Will the proposal affect current land uses on nearby or adjacent properties? If so, describe.

The project site is primarily within the railroad right-of-way. It is currently used by freight and Sounder commuter trains. The existing surrounding land uses are primarily industrial and commercial properties (Figure 2).

b. Has the project site been used as working farmlands or working forest lands? If so, describe. How much agricultural or forest land of long-term commercial significance will be converted to other uses as a result of the proposal, if any? If resource lands have not been designated, how many acres in farmland or forest land tax status will be converted to nonfarm or nonforest use?

The project site has not been used for agriculture.

1) Will the proposal affect or be affected by surrounding working farm or forest land normal business operations, such as oversize equipment access, the application of pesticides, tilling and harvesting? If so, how?

No worked farm or forest land exists in the highly urbanized project area.

c. Describe any structures on the site.

The existing single-track wooden Tacoma Trestle structure is located on the project site.

d. Will any structures be demolished? If so, what?

The proposed project includes demolition and track removal of the existing single-track trestle and associated retaining walls. In addition, a two-story warehouse may be acquired and demolished.

e. What is the current zoning classification of the site?

The project site is primarily within a Light Industrial (M1) zone, except for the west approach, west of East G Street, which is in the Downtown Mixed Use (DMU) zone (Figure 3).

f. What is the current comprehensive plan designation of the site?

The eastern portion of the project (beyond East L Street) is located within the City of Tacoma's designated Port of Tacoma Manufacturing/Industrial Center and is designated for High Intensity land use. The western portion of the site (west of East L Street) is located within the Downtown Regional Growth and Mixed Use Center (City of Tacoma 2013a; City of Tacoma 2013b).

g. If applicable, what is the current shoreline master program environment designation of the site?

Not applicable. The project site lies outside the boundary of the shoreline master program.

h. Has any part of the site been classified as a critical area by the city or county? If so, specify.

The project site is located at the northeastern edge of the Central Pierce County Sole Source Aquifer (EPA 2008). Portions of the project area are also located within a moderate volcanic hazard area and contain steep slopes (City of Tacoma 2014). Mapped slopes greater than 25 percent are located west of East G Street and west of East L Street. No wetlands have been previously mapped by the City in the project area, but three wetlands and one ditch were identified during the project wetland delineation.

i. Approximately how many people would reside or work in the completed project?

No residential development is proposed as part of the project. The proposed project would create no long term workforce.

j. Approximately how many people would the completed project displace?

The proposed project would not displace any residents. Approximately two businesses may be displaced.

k. Proposed measures to avoid or reduce displacement of other impacts, if any:

Sound Transit would compensate affected property owners according to the provisions specified in Sound Transit's adopted Real Estate Property Acquisition and Relocation Policy, Procedures, and Guidelines (Resolution #R98-20-1). Sound Transit would comply with the provisions of the federal Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (49 CFR 24, as amended, and the State of Washington's relocation and property acquisition regulations (WAC-468-100 and RCW 8.26). Benefits would vary depending on the level of impact, available relocation options, and other factors.

l. Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:

The project continues the existing transportation use of the corridor. Transportation is a permitted use in both the Light Industrial and Urban Center Mixed-Use zones. The project is consistent with the City of Tacoma Comprehensive Plan, the South Downtown Subarea Plan, and the Tacoma Dome Area Plan.

m. Proposed measures to ensure the proposal is compatible with nearby agricultural and forest lands of long-term commercial significance, if any:

No agricultural or forest lands exist in the project area.

9. Housing

a. Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.

No residential development is included as part of the proposed project.

b. Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income.

The proposed project would not displace any residential properties.

c. Proposed measures to reduce or control housing impacts, if any:

Because the proposed project would not impact housing, no measures are necessary to reduce or control housing impacts.

10. Aesthetics

a. What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?

The maximum height of the new concrete bridge structure is approximately 45 feet. This is the same as the existing timber trestle. Appurtenances mounted to the bridge, such as railroad signal supports, could be as high as 60 feet above the existing ground.

b. What views in the immediate vicinity would be altered or obstructed?

The City of Tacoma has indicated that the trestle is a unique feature as part of the rail and industrial heritage of the area, that light is able to pass beneath the trestle structure, and that the East G Street crossing is a gateway to the Freighthouse Square, Tacoma Dome, and transit center area. The proposed improvements would be similar in scale to the existing trestle and compatible with the character of the surrounding industrial area. No scenic vistas would be affected. The new bridge would also include a crossing at East G Street.

c. Proposed measures to reduce or control aesthetic impacts, if any:

Existing development surrounding the project site is generally industrial and commercial. Since the visual character and scale of the proposed project elements would be compatible with the existing character of the project site and surrounding uses, no mitigating measures are necessary. To help ensure the project considers aesthetics concerns, Sound Transit has conducted and will continue to conduct public outreach and stakeholder coordination to help inform the project design.

11. Light and Glare

a. What type of light or glare will the proposal produce? What time of day would it mainly occur?

No new lighting is proposed. Four new track signals associated with the new bridge structure are not expected to produce a substantial amount of light or glare. As the design progresses, decorative lighting may be placed to up-light the structure.

b. Could light or glare from the finished project be a safety hazard or interfere with views?

The new track signals are intended to accommodate train safety within the project area and would not be a safety hazard or interfere with views. The decorative up-lighting would be of a low intensity and not impact safety or increase glare.

c. What existing off-site sources of light or glare may affect your proposal?

No off-site sources of light or glare would affect the proposed project.

d. Proposed measures to reduce or control light and glare impacts, if any:

No light and glare impacts are anticipated. Therefore, no additional measures are proposed.

12. Recreation

a. What designated and informal recreational opportunities are in the immediate vicinity?

No designated or informal recreational opportunities are located in the immediate vicinity of the project site.

b. Would the proposed project displace any existing recreational uses? If so, describe.

The proposed project would not displace any existing recreational uses.

c. Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:

Since the proposed project would not result in any impacts on recreation, no measures are necessary or proposed to reduce or control impacts.

13. Historic and Cultural Preservation

a. Are there any buildings, structures, or sites, located on or near the site that are over 45 years old listed in or eligible for listing in national, state, or local preservation registers located on or near the site? If so, specifically describe.

The Tacoma Trestle was determined eligible for the National Register of Historic Places (NRHP) by FTA through consultation with the Department of Archaeology and Historic Preservation (DAHP) due to its unusual design and its direct association to the broad patterns of development and growth of downtown Tacoma.

b. Are there any landmarks, features, or other evidence of Indian or historic use or occupation. This may include human burials or old cemeteries. Are there any material evidence, artifacts, or areas of cultural importance on or near the site? Please list any professional studies conducted at the site to identify such resources.

The DAHP statewide predictive model identifies this general vicinity as high to very high likelihood of prehistoric archaeological resources based upon environmental factors including the proximity to the rich coastal resources of Commencement Bay, the existence

of multiple Native American place names, and recorded prehistoric archaeological site within one mile of the project area (ESA 2013). Original land surveys of the project area show swampy marsh land, with tributaries that drained into Commencement Bay north and west of the project area. However, extensive historic dredging and filling of Commencement Bay and the Puyallup River in and around the Tacoma Trestle project area during the late nineteenth and early twentieth century's possibly disturbed or destroyed evidence of any earlier human occupation. Also, the trestle has been remodeled and reconstructed at various times (since it was originally built in 1908) with associated extensive ground disturbance.

The likelihood for historic (older than 50 years) archaeological material appears high, since there is documented sustained use of the property since at least the late 1800s with multiple episodes of construction and demolition of warehouses, factories, and other facilities in the Area of Potential Effects (ESA 2013). It is likely that construction, demolition, and use has left behind artifacts (e.g. refuse) and features (e.g., foundations, pits) associated with the early growth of the industrial life in Tacoma.

During archaeological monitoring of geotechnical bores for conceptual engineering, an archaeologist recorded pre-contact cultural materials at approximately 25 to 30 feet below surface (HRA 2013). One additional bore was drilled 5 feet west of the positive bore, but no additional materials were observed. DAHP determined that the cultural materials were an isolated find and were not eligible for listing in the NRHP.

Based upon the discovery of a potential isolated archaeological find during geotechnical boring and the sedimentary and ethnohistoric contexts of the project area, there remains a high probability of encountering archaeological resources within the area of potential effect.

c. Describe the methods used to assess the potential impacts to cultural and historic resources on or near the project site. Examples include consultation with tribes and the Department of Archaeology and Historic Preservation, archaeological surveys, historic maps, GIS data, etc.

Sound Transit has conducted research to document potential impacts to cultural and historic resources on or near the proposed project, including the following: 1) consultation with DAHP, the Puyallup Tribe of Indians, Nisqually Indian Tribe, Confederated Tribes and Bands of the Yakama Nation, and Steilacoom Tribe on the APE and ongoing studies and monitoring; 2) review and identification of available background information from sources such as DAHP, University of Washington, and Sound Transit (at least seven previous cultural resources surveys were identified within one mile of the Trestle); 3) field inventory of above-ground resources in 2012 by ESA Paragon; 4)archaeological monitoring of geotechnical bores in 2013; and 5) archaeological monitoring of geotechnical bores and archaeological investigations in 2014.

d. Proposed measures to avoid, minimize, or compensate for loss, changes to, and disturbance to resources. Please include plans for the above and any permits that may be required.

A Memorandum of Agreement (MOA) has been developed pursuant to Section 106 of the National Historic Preservation Act with FTA, DAHP, Sound Transit, and consulting parties (the Cascade Rail Foundation, the City of Tacoma Historic Preservation Office, Historic Tacoma, the Federal Railroad Administration, the Tacoma Chapter of the National Railway Historical Society, the Nisqually Indian Tribe, the Puyallup Tribe of Indians, and the Tacoma

Historical Society) to address both archaeological and historic resources (see Attachment C). Pre-construction archaeological investigations have been completed in accordance with the Section 106 MOA to further assess the risk for encountering archaeological material within the APE. Based on the results and continued consultation with DAHP and interested tribes, if monitoring during construction is recommended, it will be conducted under the terms of an Archaeological Resources Monitoring and Treatment Plan (ARMTP). This plan will outline procedures and protocols to be followed during construction. An unanticipated discovery plan will also be in place prior to construction.

The proposed project will result in an adverse effect to the NRHP eligible Tacoma Trestle by replacing it. The MOA identifies mitigation measures that will be implemented to mitigate the adverse effect (Attachment C). These measures include: documentation of the historic trestle, an essay on historylink.org, an article in a railroad publication, incorporation of the Milwaukee Road logo into the new bridge, and installation of an interpretive display. DAHP will also be provided an opportunity to review the design of the replacement bridge.

14. Transportation

a. Identify public streets and highways serving the site or affected geographic area, and describe proposed access to the existing street system. Show on site plans, if any.

The project site is served by East G, J, and L Streets from the north and south (see Attachment A). East 25th Street parallels the site to the north and East 26th Street parallels the site to the south. No modifications to site access are proposed as part of the proposed project. There will be no long term changes to pedestrians of traffic circulation as a result of the project. Some short-term diversions or delays in pedestrian movements may occur during construction, usually lasting less than ten minutes while equipment is being positioned. A few longer closures (up to a few days each) may be necessary at the crossings of East 26th Street and G Street as well as at East J Street when the new bridge spans are being erected. Pedestrian detours to the other side of the street would be provided during longer closures.

b. Is the site or affected geographic area currently served by public transit? If so, generally describe. If not, what is the approximate distance to the nearest transit stop?

The Tacoma Dome Station, a multi-modal transit facility serving Sounder commuter rail, Tacoma Link light rail, and Greyhound local and express bus lines is located just west of the project site (Figure 1).

c. How many additional parking spaces would the completed project or nonproject proposal have? How many would the project or proposal eliminate?

The proposed project would not provide any parking spaces. No spaces would be permanently eliminated. Up to 20 parking spaces may be temporarily eliminated along East 26th Street, along East G Street, and along East J Street, as well as in a parking lot and during construction.

d. Will the proposal require any new improvements to existing roads, streets, pedestrian, bicycle or state transportation facilities, not including driveways? If so, generally describe (indicate whether public or private).

Temporary impacts during construction to the streets at the bridges of G/26th and J Street may occur. Streets will be reconstructed in-kind if impacted during construction.

The project will not will not contribute additional traffic to city streets or highways after construction. The project will also not reduce existing capacity of streets and highways in any way.

e. Will the project or proposal use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.

The proposed project will replace an existing rail bridge structure. The project does not include additional rail service and will not contribute additional traffic to city streets or highways after construction. Rail traffic will be less congested as a result of the new double-track structure and rail segment. The project will not increase the number of trains.

Construction of the project would require temporary closures of some local roads, particularly East J Street (a local collector) and East G Street (a minor collector arterial street). Closures would only be needed for limited periods of construction adjacent to and over these streets which would result in detours being put in place to provide continued access to businesses near the project location.

Impacts to both freight and passenger rail traffic are also anticipated to be minimal. Sound Transit will coordinate with Sounder Operations and Tacoma Rail to minimize disruptions to rail service during construction. The construction sequence is anticipated to allow for uninterrupted rail service.

f. How many vehicular trips per day would be generated by the completed project or proposal? If known, indicate when peak volumes would occur and what percentage of the volume would be trucks (such as commercial and nonpassenger vehicles). What data or transportation models were used to make these estimates?.

The proposed project would not generate any vehicular trips.

g. Will the proposal interfere with, affect or be affected by the movement of agricultural and forest products on roads or streets in the area? If so, generally describe.

Not applicable.

h. Proposed measures to reduce or control transportation impacts, if any:

Construction closure periods will be minimized to avoid impacts to local businesses that use these streets for access, and detour routes will be designated so that properties would be accessible during closures. Sound Transit will coordinate with all affected businesses during construction to ensure that access to adjacent properties would be maintained and/or coordinated with the property owner throughout construction. Specific haul routes will be identified in coordination with the City of Tacoma, but would be along designated truck routes in the project vicinity. Sound Transit will also coordinate with other transit and rail providers in the area including Pierce Transit and Tacoma Rail to minimize potential disruptions during construction.

15. Public Services

a. Would the project result in an increased need for public services (for example: fire protection, police protection, public transit, health care, schools, other)? If so, generally describe.

The proposed project is not expected to generate an increased need for public services.

b. Proposed measures to reduce or control direct impacts on public services, if any:

No impacts to public services are anticipated. Therefore, no measures are necessary or proposed to control impacts.

16. Utilities

a. **Underline utilities currently available at the site:**
electricity, natural gas, water, refuse service, telephone, sanitary sewer, septic system, other: storm drainage, cable communications.

Existing utilities currently available within the project area include power/phone/cable communications, water, sanitary sewer, gas, and storm drainage (DEA 2014).

b. Describe the utilities, which are proposed for the project, the utility providing the service and the general construction activities on the site or in the immediate vicinity which might be needed.

The project may result in temporary utility disruptions in the project area and are anticipated for communications, fiber optics, sanitary sewer, and storm sewer. Others, like water and power, may be slightly impacted. Three parallel utilities are very likely to be impacted by the project and will require relocation. They are an underground communications line generally running along the north side of the corridor, another communications line generally running along the south side of the corridor, and a sanitary sewer line located a short distance alongside in the alley at the southwest end of the corridor. Although unlikely, some of the transverse utilities may be impacted due to the planned bridge pile locations. Potholing will be utilized to verify alignment and depth of the utility and, if feasible, the bridge pile locations will be adjusted to avoid the utility. If the pile cannot be adjusted, the utility will be relocated prior to bridge construction. Some overhead power may be temporarily relocated or de-energized during construction.

C. Signature

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Gray Rand

Name of Signee: Gray Rand

Position and Agency/Organization: Senior Scientist, David Evans and Associates, Inc.

Date Submitted: 7/8/14

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Figures

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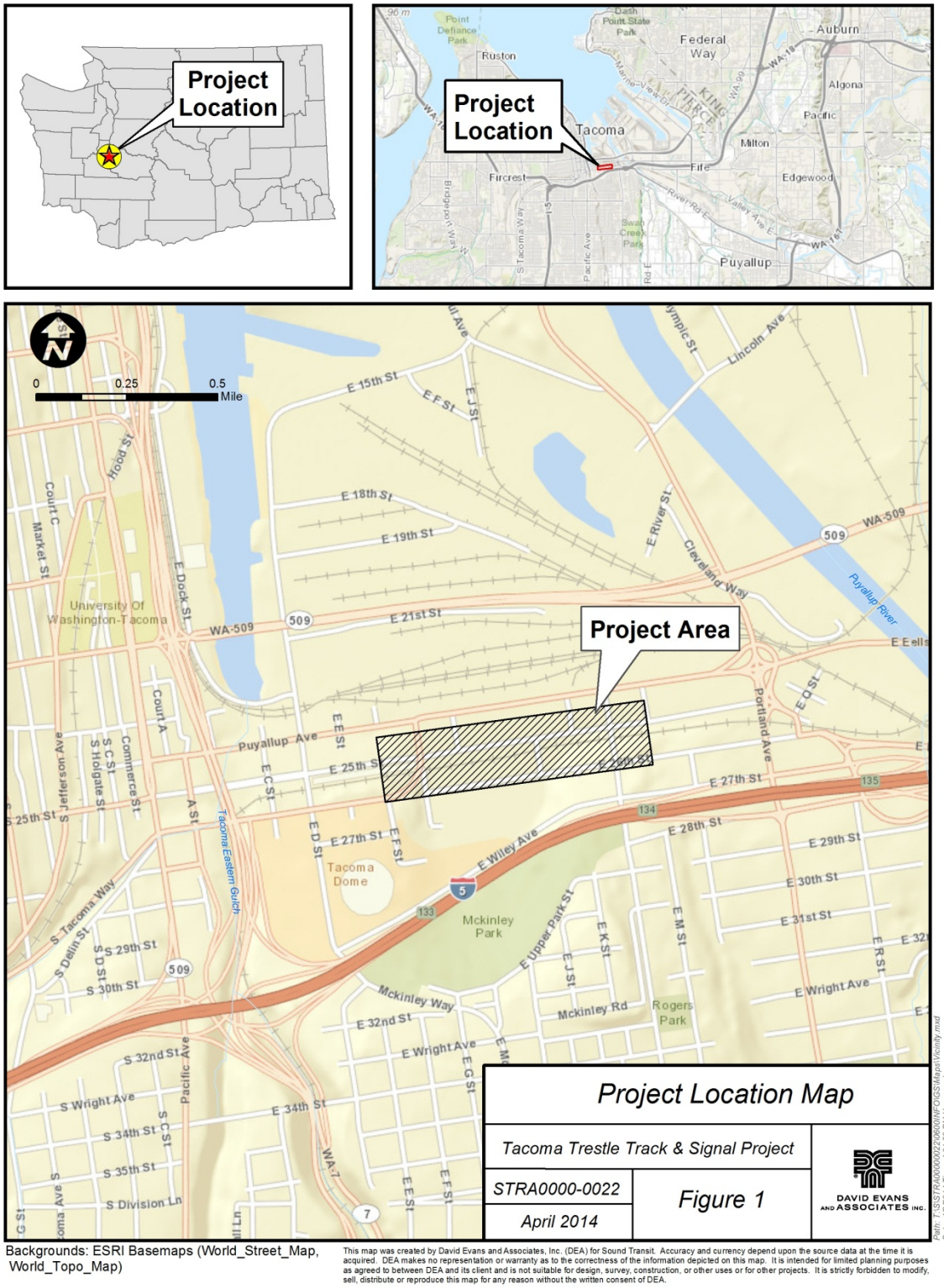
Figure 1. Project Location Map


Project Location
Project Location
Project Area
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Federal Way
Auburn
Puyallup
Fife
Fircrest
Milton
Edgewood
Ruston
Algona
Pacific
University Of Washington-Tacoma
Tacoma Dome
Mckinley Park
Rogers Park
Tacoma Eastern Gulch
Puyallup River
0
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Project Location Map
Tacoma Trestle Track & Signal Project
STRA0000-0022
April 2014
Figure 1
DAVID EVANS AND ASSOCIATES INC.
Backgrounds: ESRI Basemaps (World_Street_Map, World_Topo_Map)
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Figure 2. Project Site and Surrounding Land Uses

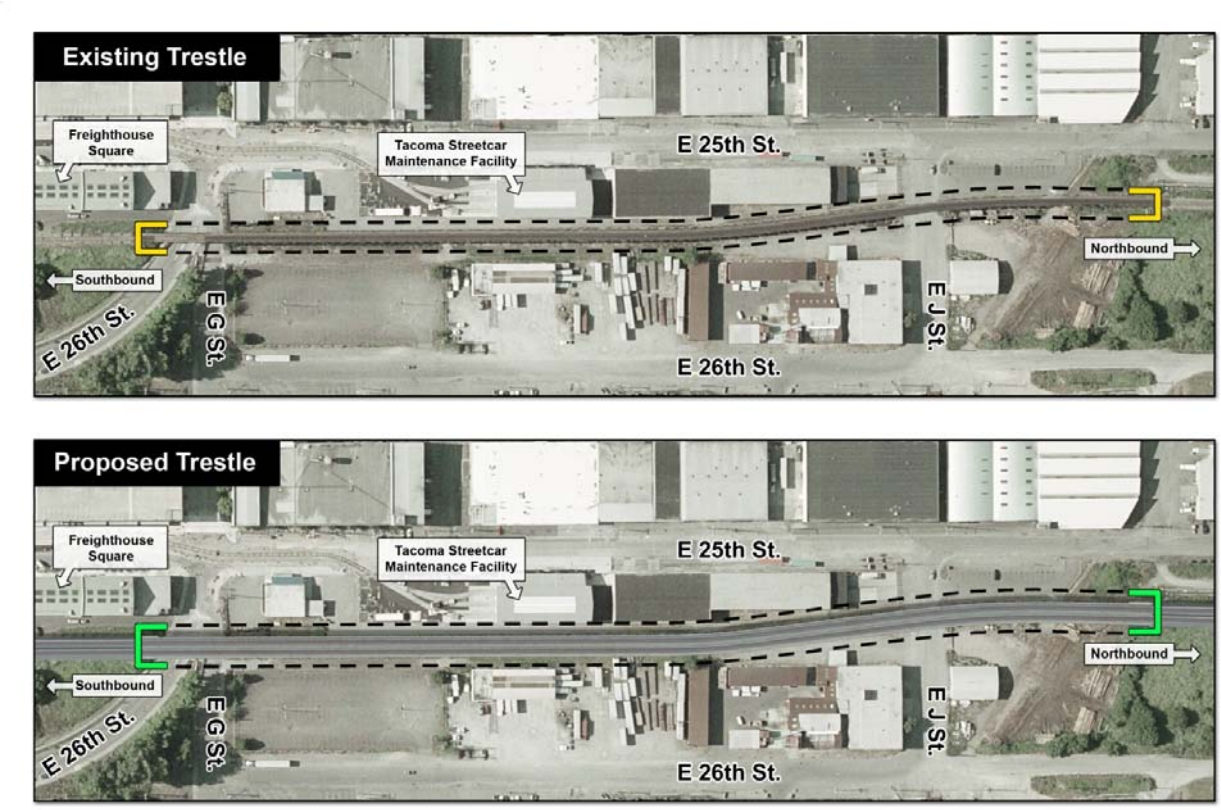
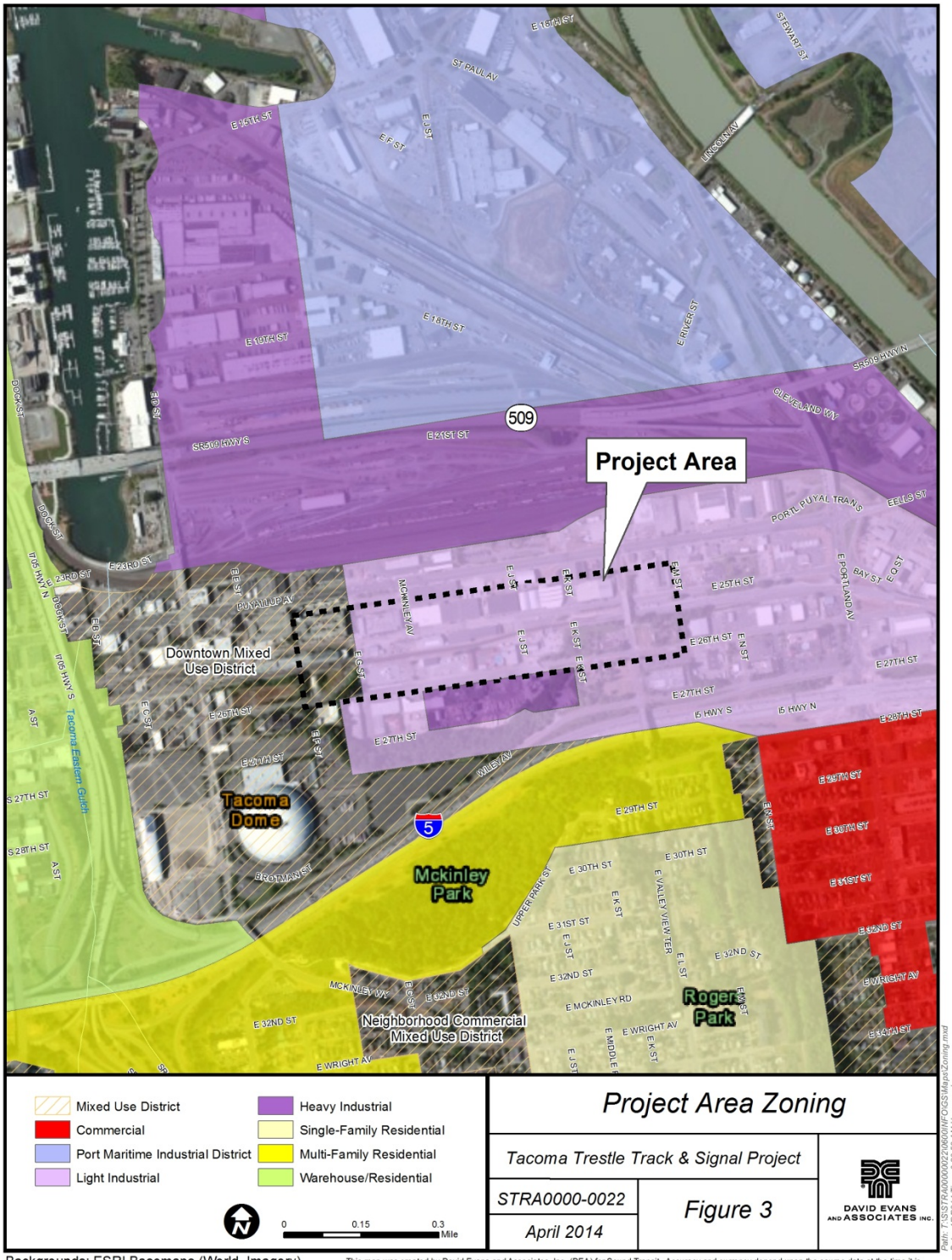


Figure 3. Project Area Zoning



Backgrounds: ESRI Basemaps (World_Imagery), City of Tacoma Zoning, Pierce County Roads

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Attachments

A. Preferred Alternative Plan Sheets

B. Noise and Vibration Technical Memorandum

C. Memorandum of Agreement

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Attachment A

Plan Sheets

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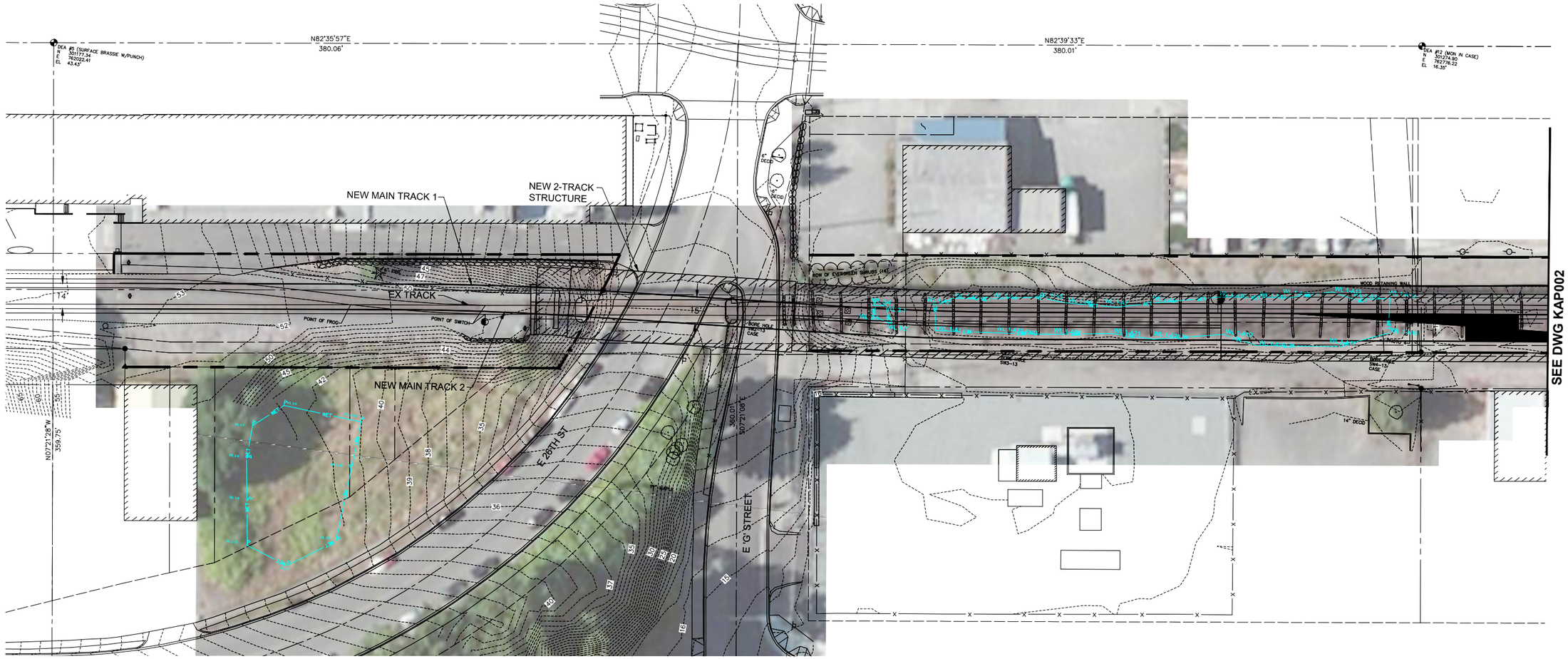

SEE DWG KAP002

LEGEND:

- NEW O/L SHIFTED TRACK
- NEW 2-TRACK STRUCTURE
- EXISTING RAILROAD RIGHT OF WAY LINE
- WETLAND BOUNDARY

N

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SCALE IN FEET

No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: K. JEFFERS
DRAWN BY: C. BRESLEY
CHECKED BY: J. ELLERBROEK
APPROVED BY:

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SUBMITTED BY: | DATE: | REVIEWED BY: | DATE:

LINE IS 1" AT FULL SCALE

SOUNDTRANSIT

SCALE: AS SHOWN
FILENAME: SCRTT-KAP001
CONTRACT No.:
DATE: 07/01/14

SOUNDER-TACOMA TRESTLE TRACK & SIGNAL

SEPA CHECK-LIST ATTACHMENT A

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SHEET No.: 1
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SUBMITTED BY: | DATE: | REVIEWED BY: | DATE:

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SOUNDTRANSIT

SCALE: AS SHOWN
FILENAME: SCRTT-KAP002
CONTRACT No.:
DATE: 07/01/14

SOUNDER-TACOMA TRESTLE TRACK & SIGNAL

SEPA CHECK-LIST ATTACHMENT A

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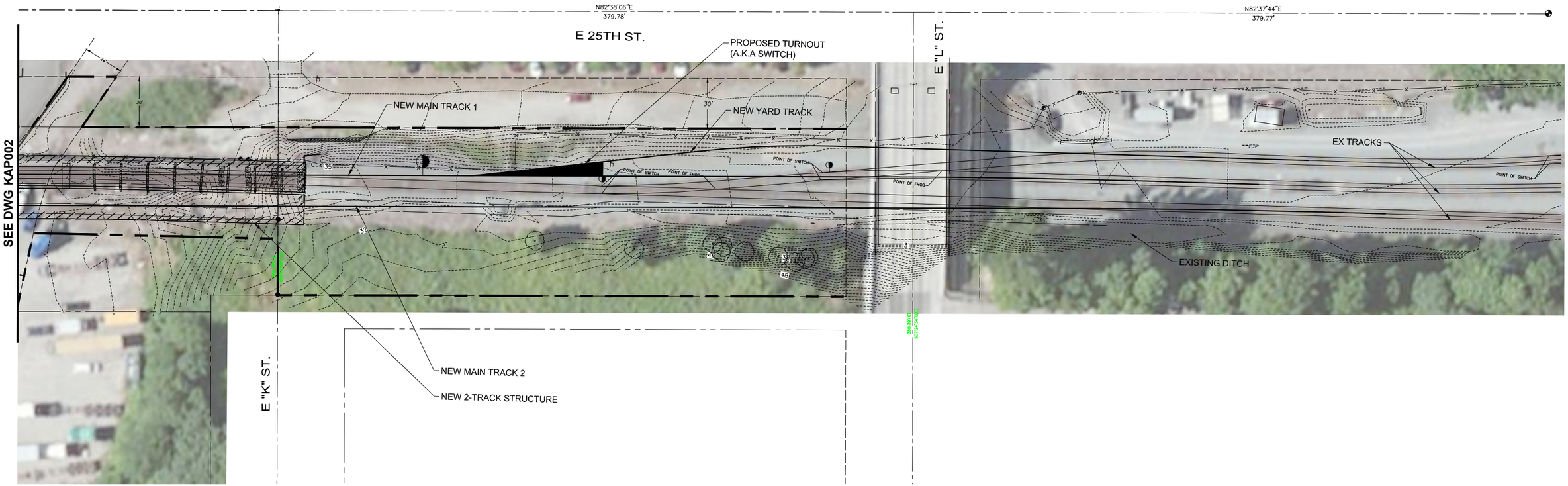

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- EXISTING RAILROAD RIGHT OF WAY LINE
- WETLAND BOUNDARY

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No.	DATE	DSN	CHK	APP	REVISION

DESIGNED BY: K. JEFFERS
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SUBMITTED BY: | DATE: | REVIEWED BY: | DATE:

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SOUNDTRANSIT

SCALE: AS SHOWN
FILENAME: SCRTT-KAP003
CONTRACT No.:
DATE: 07/01/14

SOUNDER-TACOMA TRESTLE TRACK & SIGNAL

SEPA CHECK-LIST ATTACHMENT A

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Attachment B

Noise and Vibration Technical Memorandum

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Noise and Vibration Technical Memorandum

Tacoma Trestle Track & Signal Project

Prepared for

Sound Transit

Contact: RTA/AE 0038-13

March 31, 2014

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Contract # 141496

Prepared by
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for
Sound Transit, Seattle Washington

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DOCUMENT CHANGE CONTROL SHEET

Document Title: Noise and Vibration Technical Memorandum

Date	Version #	Author	Status	Revision Description
1/4/2014	Version 1	Michael Minor	N/A	Initial Draft
1/6/2014	Version 1a	Michael Minor	Review	Initial internal review
1/6/2014	Version 1b	Maggie Buckley	Review	DEA review
1/6/2014	Version 1c	Michael Minor	Editing	Revised per DEA comments, updated graphics and added receiver.
1/23/2014	Version 2	Michael Minor	Editing	Revised per Sound Transit Comments
3/6/2014	Version 3	Michael Minor	Revised	Revised per Sound Transit Comments from teleconference
3/6/2014	Version 3	Maggie Buckley	Review	Backchecking revisions
3/28/2014	Version 4	Michael Minor	Revised	Revised to use cumulative noise levels per Sound Transit request
3/31/2041	Version 4a	Michael Minor	Revised	Final edits per Sound Transit

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1. Project Introduction

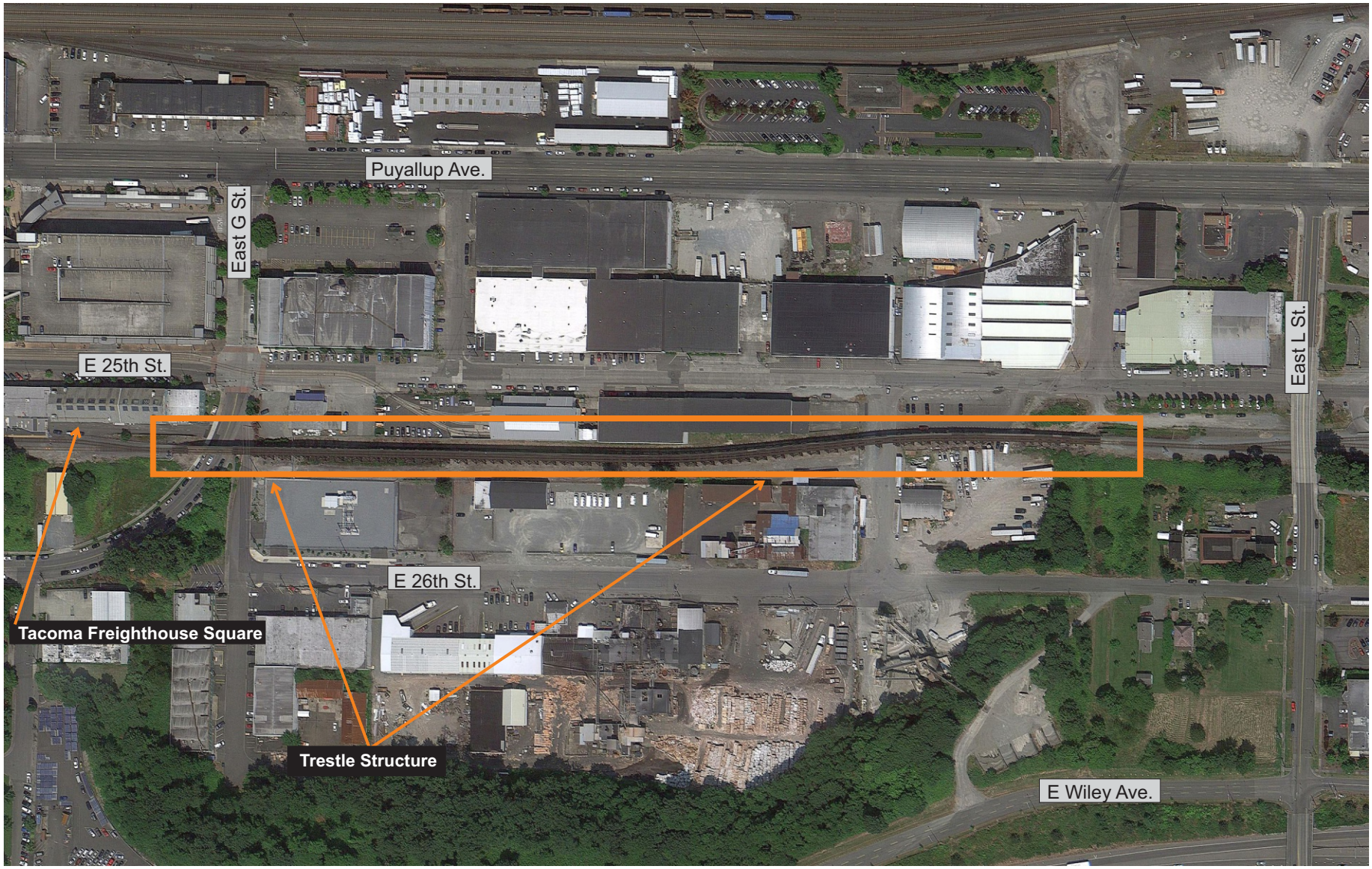
The purpose of this analysis is to review and identify noise and vibration impacts using the FTA noise and vibration impact criteria as provided in the Transit Noise and Vibration Impact Assessment, FTA, May 2006 (FTA, 2006). In addition, noise related to project construction is discussed. Where noise and/or vibration impacts are identified, noise and/or vibration mitigation measures are examined and recommended.

2. Project Description

The Tacoma Trestle Track & Signal Project (Tacoma Trestle Project) will replace a single-track wooden trestle within an approximately 0.65-mile section of the Sounder Commuter Rail/Amtrak corridor with a double-track bridge structure, plus related track improvements. The Tacoma Trestle Project is located generally from Freighthouse Square (near East G Street) to East M Street in Tacoma, Pierce County, Washington. The project is in the City of Tacoma's Tacoma Dome District and adjacent to the Tacoma Dome Station, a multi-modal transit facility serving Sounder commuter rail, Tacoma Link light rail, Greyhound, local and express bus. The location of the trestle is shown on Figure 1.

The purpose of the project is to improve rail movement in an area of growing rail use in Tacoma to improve reliability for passenger and commuter rail service and reduce delays for freight movement. Currently, the single track Tacoma Trestle is a bottleneck for rail movement and causes congestion and delay for passenger and freight rail service through the project area. Double tracks are positioned on both east and west sides of the existing trestle, which means that trains using the trestle must be held so that only one train is allowed to pass over the trestle at any given time. The current conditions of the trestle also limit train speeds to ten miles per hour (mph).The trestle and tracks in the area serve the Port of Tacoma and Sound Transit commuter rail. The trestle will also be used by Amtrak Cascades and Coast Starlight trains beginning in 2017. The proposed project will increase train speeds across the trestle to 30 mph and allow two trains to cross the trestle simultaneously.

Specific elements of the Tacoma Trestle Project include demolition and track removal of the existing single track trestle, upgrades to the embankment along the trestle approaches, construction of a double-track bridge structure with tracks and crossovers, construction of a deck girder, signal upgrades and erosion control. Additional earthen fill and retaining wall structures will be required for construction of the new bridge structure. The trestle replacement will involve three basic steps or stages: 1) construct the first track on the new bridge structure parallel to the existing trestle and connect to the existing tracks; 2) demolish and remove the existing trestle; 3) construct the second track and connect to the other existing track. The project would also likely require changes to signals and control points near the trestle.



Trestle Location

0 125 250 500

1.00 in

Approximate Scale 1 inch to 250 feet

N

Michael Minor & Associates
Sound.Vibration.Air
Portland, Oregon

Figure 1
Project Area Overview
Tacoma Trestle Project

3. Introduction to Noise and Vibration

The following sections include background information on noise and vibration. Also included are the relevant standards and criteria and a summary of the potential noise and vibration impacts resulting from the project.

3.1. Introduction to Noise

What we hear as sound is a series of continuous air pressure fluctuations superimposed on the atmospheric pressure that surrounds us. The amplitude of fluctuation is related to the energy carried in a sound wave; the greater the amplitude, the greater the energy and the louder the sound. The full range of sound pressures encountered in the world is so great that it is more convenient to compress the range by using a logarithmic scale, resulting in the fundamental descriptor used in acoustics, the sound pressure level, in decibels (dB). When sounds are unpleasant, unwanted, or disturbingly loud, we tend to classify them as noise.

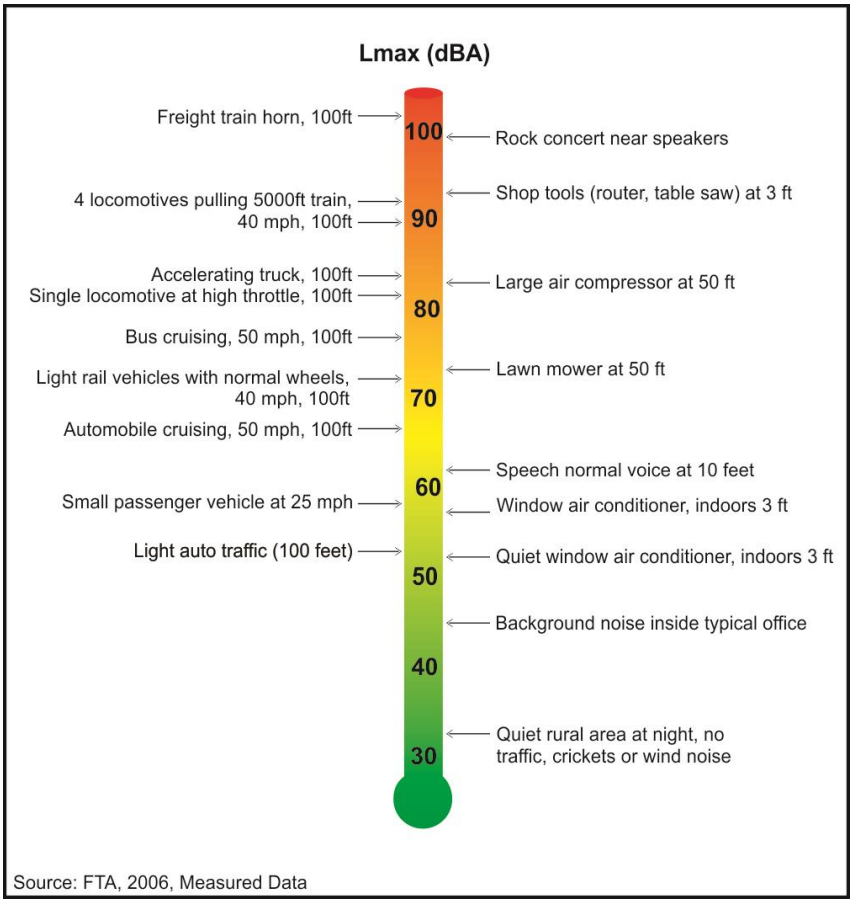
Another aspect of sound is the quality described as its pitch. Pitch is established by frequency, which is a measure of how rapidly a sound wave fluctuates as measured in cycles per second or Hertz (Hz). Most sounds are a composite of many individual frequencies. When a sound is analyzed, its energy content at individual frequencies is displayed over the frequency range of interest, usually the range of human audibility, from about 20 Hz to about 20,000 Hz. This display is called a frequency spectrum.

Sound is measured using a sound level meter with a microphone designed to respond accurately to all audible frequencies. The human hearing system does not respond equally to all frequencies. Low frequency sounds below about 400 Hz are progressively and severely attenuated, as are high frequencies above 10,000 Hz. To approximate the way humans interpret sound, a filter circuit with frequency characteristics similar to the human hearing mechanism is built into sound level meters. Measurements with this filter enacted are called A-Weighted Sound Levels, expressed in A-weighted decibels (dBA). Community noise is usually characterized in terms of the A-weighted sound level. Figure 2 illustrates the A-weighted levels of common sounds. When sounds exceed 110 dBA, there is a potential for hearing damage, even with relatively short exposures. In quiet suburban areas far from major freeways, the noise levels during the late night hours will drop to about 30 dBA. Outdoor noise levels lower than this only occur in isolated areas where there is a minimum of natural noises such as leaves blowing in the wind, crickets, or flowing water.

Noise levels from most sources tend to vary with time. For example, noise levels increase when a car approaches, then reach a maximum peak as it passes, and decrease as the car moves farther away. In this example, noise levels within a 1 minute timeframe may range from 45 dBA as the vehicle approaches, increase to 65 dBA as it passes by, and return to 45 dBA it moves away. To account for the variance in loudness, over time, a common noise measurement is the equivalent sound pressure level (Leq). The Leq is defined as the energy average noise level, in dBA, for a specific time period (for example, 1 minute). Therefore, assuming the energy average noise level was 60 dBA during the entire period of time the car could be heard as it passed by; the noise level would be stated as 60 dBA Leq.

The Leq is a primary noise descriptor, and is used by the Federal Highway Administration, the Federal Transit Administration, the Federal Aviation Administration along with most other local noise ordinances and regulations.

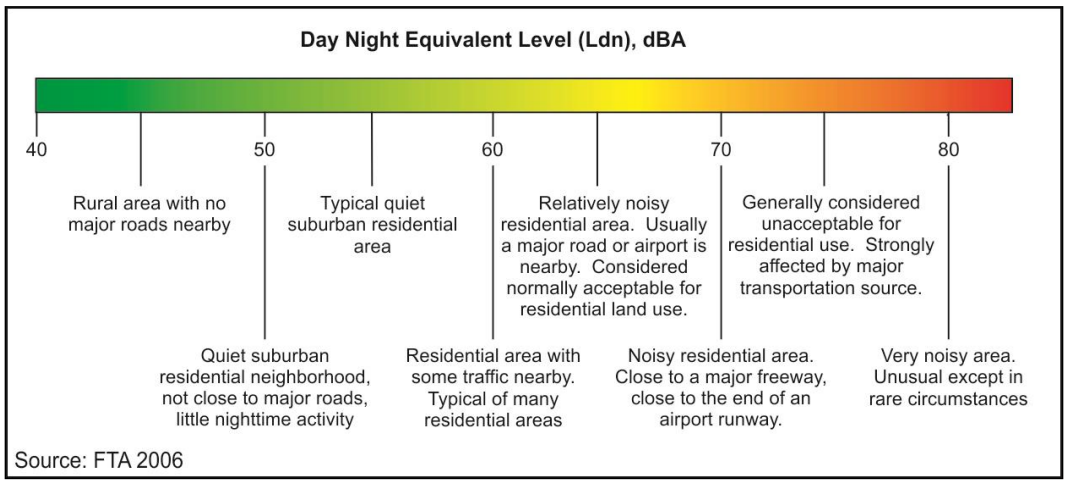
Figure 2. Typical A-Weighted Sound Levels


Lmax (dBA)
Freight train horn, 100ft
100
Rock concert near speakers
Shop tools (router, table saw) at 3 ft
4 locomotives pulling 5000ft train, 40 mph, 100ft
90
Accelerating truck, 100ft
Single locomotive at high throttle, 100ft
Large air compressor at 50 ft
80
Bus cruising, 50 mph, 100ft
Lawn mower at 50 ft
Light rail vehicles with normal wheels, 40 mph, 100ft
70
Automobile cruising, 50 mph, 100ft
Speech normal voice at 10 feet
60
Small passenger vehicle at 25 mph
Window air conditioner, indoors 3 ft
Light auto traffic (100 feet)
Quiet window air conditioner, indoors 3 ft
50
Background noise inside typical office
40
Quiet rural area at night, no traffic, crickets or wind noise
30
Source: FTA, 2006, Measured Data

The lower average noise levels during nighttime hours, when human activities are at a minimum, and the higher noise levels during daytime hours are daily patterns of noise level fluctuation. The instantaneous A-weighted sound level is insufficient to describe the overall acoustic "environment." A more useful descriptor is the Day-Night Equivalent Sound Level, L_{dn}, also abbreviated DNL, which is defined as the 24-hour equivalent levels (L_{eq}) but with a 10 dB penalty assessed to noise events occurring at night (defined as 10:00 p.m. to 7:00 a.m.). The effect of this penalty is that any event during the nighttime hours is equivalent to ten events during the daytime hours. This strongly weights L_{dn} toward nighttime noise to reflect the fact that most people are more easily annoyed by noise during the nighttime hours, when background noise is lower and most people are sleeping.

Environmental impact assessments for high capacity transit projects in the United States typically use L_{dn} to describe the community noise environment. Studies of community response to a wide variety of noises indicate that L_{dn} is a good measure of noise environment. Figure 3 defines typical community noise levels in terms of L_{dn}. Most urban and suburban neighborhoods will be in the range of L_{dn} 50 to 70 dBA. An L_{dn} of 70 dBA is a relatively noisy environment that might be found at buildings on a busy surface street, close to a freeway or near a busy airport. It would usually be considered unacceptable for residential land use without special measures taken to enhance outdoor-indoor sound insulation. Residential neighborhoods that are not close to major sound sources will usually be in the range of L_{dn} 55 to 60 dBA. If there is a freeway or moderately busy arterial nearby, or any nighttime noise, L_{dn} is usually in the range of 60 to 65 dBA.

Figure 3. Typical L_{dn} Levels


Day Night Equivalent Level (Ldn), dBA
40
50
60
70
80
Rural area with no major roads nearby
Typical quiet suburban residential area
Relatively noisy residential area. Usually a major road or airport is nearby. Considered normally acceptable for residential land use.
Generally considered unacceptable for residential use. Strongly affected by major transportation source.
Quiet suburban residential neighborhood, not close to major roads, little nighttime activity
Residential area with some traffic nearby. Typical of many residential areas
Noisy residential area. Close to a major freeway, close to the end of an airport runway.
Very noisy area. Unusual except in rare circumstances
Source: FTA 2006

- The following list contains some general rules for community noise: A 3 dB change is the minimum most people will notice in most urban environments.
- Under free-field conditions, where there are no reflections or additional attenuations, a point sound source is known to decrease at a rate of 6 dB for each doubling of distance. This is commonly known as the inverse square law. For example, a sound level of 70 dB at a distance of 100 feet would decrease to 64 dB at 200 feet.
- A 10 dB increase in sound level is perceived as an approximate doubling of the loudness of the sound and represents a substantial change in loudness.

An important factor to recognize is that noise is measured on a decibel scale, and combining two noises is not achieved by simple addition. For example, combining two 60 dB noises does not give 120 dB (which is near the pain threshold), but yields 63 dB which is lower than the volume at which most people listen to their TVs. For reference, if two noise sources are 10 dB apart, for example 50 dB and 60 dB, the sum of the two noise levels will simply be the louder of the two, in this case 60 dB. This is to say that for similar noise sources that are 10 dB apart in magnitude, a person would only be able to hear the louder of the two sources. Examples of simplified decibel addition, based on the difference between the two levels, are provided below for reference as they will aid in the understanding of the project noise impact analysis.

Difference between the two noise sources	Amount added to the higher of the two noise levels
0 to 1 dB	3 dB
2 to 3 dB	2 dB
4 to 9 dB	1 dB
10 dB or more	0 dB

3.2. Introduction to Vibration

Ground-borne vibration consists of oscillatory waves that propagate from the source through the ground to adjacent buildings. On steel-wheel/steel-rail train systems, ground-borne vibration is created by the interaction of the steel wheels rolling on the steel rails. Although the vibration is sometimes noticeable outdoors, it is almost exclusively an indoor problem. Although it is conceivable for ground-borne vibration from rail rapid transit trains to cause building damage, the vibration from trains is almost never of sufficient amplitude to cause even minor cosmetic damage to buildings. The primary concern is that the vibration and radiated noise can be intrusive and annoying to building occupants. The building vibration caused by ground-borne vibration may be perceived as motion of building surfaces; rattling of windows, items on shelves, or pictures hanging on walls; or as a low-frequency rumbling noise, which is referred to as ground-borne noise. Factors that influence the amplitudes of ground-borne vibration include vehicle suspension parameters, condition of the wheels and rails, type of track, track support system, type of building foundation, and the properties of the soil and rock layers through which the vibration propagates.

Ground-borne vibration is not a widespread environmental problem, and it is generally limited to localized areas near rail systems, construction sites, and some industrial operations. Road traffic rarely creates perceptible ground-borne vibration except when there are bumps, potholes or other discontinuities in the road surface. When traffic causes phenomena such as rattling of windows, the cause is more likely to be "acoustic excitation" rather than ground-borne vibration. The unusual situations where traffic or other existing sources are causing intrusive vibration can be an indication of geologic conditions that would result in higher than normal levels of train vibration.

Vibration is an oscillatory motion that can be described in terms of the displacement, velocity, or acceleration of the oscillations. Ground-borne vibration is usually characterized in terms of the vibration velocity because over the frequency range relevant to ground-borne vibration (about one to 200 Hz). Both human and building response tends to be more proportional to velocity than either displacement or acceleration. Vibration velocity is usually given in terms of either inches per second or decibels. The following equation defines the relationship between vibration velocity in inches per second and decibels:

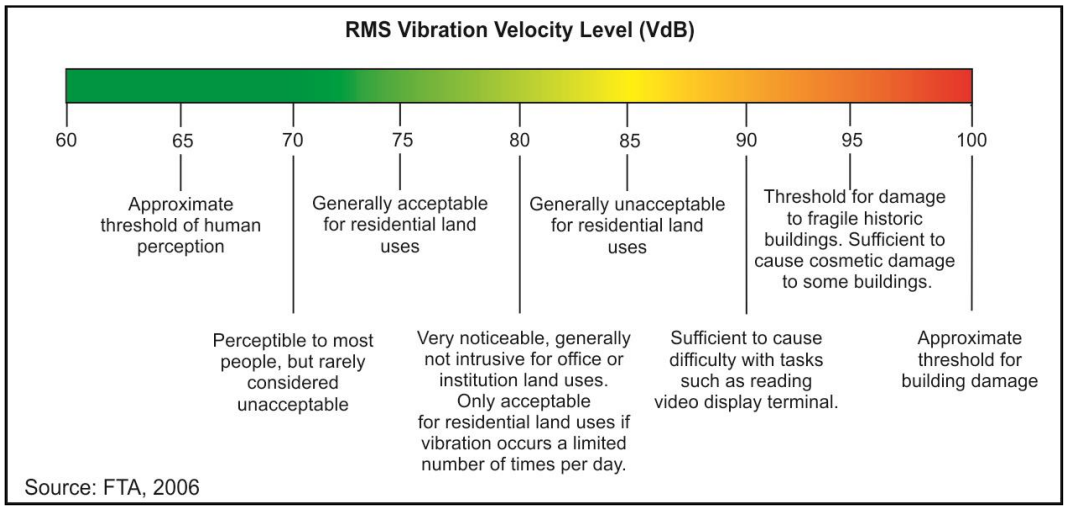
$$Lv = 20 \times \log (V/Vref);$$

Where V is the velocity amplitude in inches/second, Vref is 10^{-6} inches/second; Lv is the velocity level in decibels.

The abbreviation VdB is used for vibration decibels by the FTA and in this report, to minimize confusion with sound decibels.

Figure 4 gives a general idea of human and building response to different levels of vibration. Existing background building vibration is usually in the range of 40 to 50 VdB, which is well below the range of human perception. Although the perceptibility threshold is about 65 VdB, human response to vibration is usually not bothersome unless the RMS vibration velocity level exceeds 70 to 75 VdB. Vibration levels above 85 VdB are not normally acceptable for residential use.

Figure 4. Typical RMS Vibration Levels


RMS Vibration Velocity Level (VdB)
60
65
70
75
80
85
90
95
100
Approximate threshold of human perception
Generally acceptable for residential land uses
Generally unacceptable for residential land uses
Threshold for damage to fragile historic buildings. Sufficient to cause cosmetic damage to some buildings.
Perceptible to most people, but rarely considered unacceptable
Very noticeable, generally not intrusive for office or institution land uses. Only acceptable for residential land uses if vibration occurs a limited number of times per day.
Sufficient to cause difficulty with tasks such as reading video display terminal.
Approximate threshold for building damage
Source: FTA, 2006

4. Noise and Vibration Impact Criteria

Several different criteria were considered and used for this noise study. These include the FTA Noise Impact Criteria (2006) along with local criteria from the City of Tacoma and the Washington State Administrative Code (WAC). Because there are no planned modifications to any existing roadways, the Federal Highway Administration (FHWA) and Washington State Department of Transportation (WSDOT) criteria are not applicable to this project and are not included in this report.

4.1. FTA Noise Impact Criteria

Transit noise impacts for this project are determined based on the criteria defined in the FTA Noise and Vibration Impact Assessment Manual, 2006. The criteria are based on documented research on community reaction to noise and on change in noise exposure rated using a sliding scale. Although more transit noise is allowed in neighborhoods with high levels of existing noise, as existing noise levels increase, smaller increases in total noise exposure are allowed than in areas with lower existing noise levels. The FTA Noise Impact Criteria group noise-sensitive land uses into the following three categories:

- Category 1: Tracts of land where quiet is an essential element in their intended purpose. This category includes lands set aside for serenity and quiet and such land uses as outdoor amphitheaters and concert pavilions, as well as National Historic Landmarks with significant outdoor use. Also included in this category are recording studios and concert halls.
- Category 2: Residences and buildings where people normally sleep. This category includes homes, hospitals, and hotels where a nighttime sensitivity to noise is assumed to be of utmost importance.
- Category 3: Institutional land uses with primarily daytime and evening use. This category includes schools, libraries, theaters, and churches where it is important to avoid interference with such activities as speech, meditation, and concentration on reading material. Places for meditation or study associated with cemeteries, monuments, museums, campgrounds, and recreational facilities are also considered to be in this category. Certain historical sites and parks are also

included, but their sensitivity to noise must be related to their defining characteristics, and generally parks with active recreational facilities are not considered noise sensitive.

The Ldn is used to characterize noise exposure for residential areas (Category 2). For other noise-sensitive land uses, such as outdoor amphitheaters and school buildings (Categories 1 and 3), the maximum 1-hour Leq during the facility's operating period is used. There are no noise impact criteria for most commercial and industrial land uses.

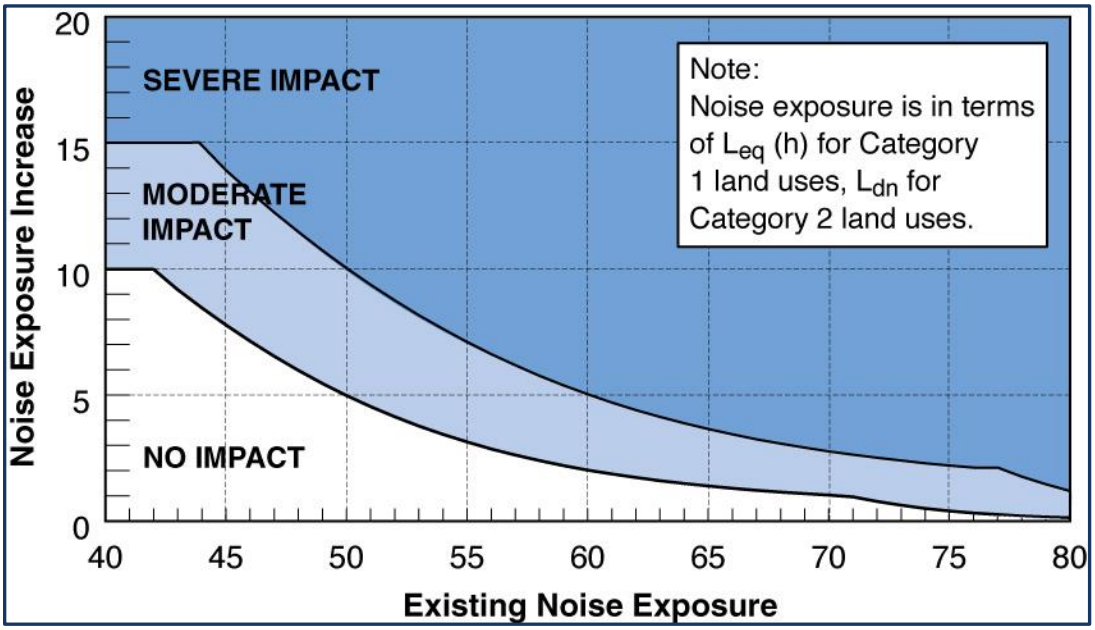
There are two levels of impact included in the FTA criteria: severe and moderate, interpreted as follows:

Severe Impact: Project-generated noise in the severe impact range can be expected to cause a large percentage of people to be highly annoyed by the new noise and represents the most compelling need for mitigation. Noise mitigation will normally be specified for severe impact areas unless there are truly extenuating circumstances that prevent it.

Moderate Impact: In this range of noise impact, the change in the cumulative noise level is noticeable to most people but may not be sufficient to cause strong, adverse reactions from the community. In this transitional area, other project-specific factors must be considered to determine the magnitude of the impact and the need for mitigation. These factors include the existing level, the projected level of increase over existing noise levels, the types and numbers of noise-sensitive land uses affected, the noise sensitivity of the properties, the effectiveness of the mitigation measures, community views, and the cost of mitigating noise to more acceptable levels.

The FTA noise impact criteria can be presented in several different ways. For this study the selected method of analysis is to compare the existing noise levels to the allowable change in noise levels, commonly called a cumulative noise analysis. The FTA analysis criteria are shown on Figure 5. The existing noise exposure is located along the horizontal axis, and the allowable increase in noise is shown on the vertical axis. For example, a site with an existing noise exposure of 50 dBA, would have a noise impact if the cumulative noise levels increased by 5 dB, and a severe impact if the increase was greater than 10 dB.

Figure 5. FTA Noise Impact Criteria



4.2. FTA Vibration Impact Criteria

FTA has developed impact criteria for acceptable levels of ground-borne noise and vibration. Experience with ground-borne vibration from rail systems and other common vibration sources suggest that:

- Ground-borne vibration from transit trains should be characterized in terms of the RMS vibration velocity amplitude. A one-second RMS time constant is assumed. This is in contrast to vibration from blasting and other construction procedures that have the potential of causing building damage. When looking at the potential for building damage, ground-borne vibration is usually expressed in terms of the peak particle velocity (PPV).
- The threshold of vibration perception for most humans is around 65 VdB. Levels in the 72 to 75 VdB range are often noticeable but acceptable.
- For commuter transit systems that operate between 30 and 70 trains per day, limits for acceptable levels of residential ground-borne vibration are usually between 75 and 78 VdB.
- For human annoyance, there is some relationship between the number of events and the degree of annoyance caused by the vibration. It is intuitive to expect that more frequent vibration events, or events that last longer, will be more annoying to building occupants. To account for the fact that most commuter rail systems have fewer daily operations than the typical urban transit line, the criteria in the FTA Guidance Manual (ref. 1) includes a higher impact threshold if there are fewer than 70 trains per day.
- Ground-borne vibration from any type of train operations will rarely be high enough to cause any sort of building damage, even minor cosmetic damage. The only real concern is that the vibration will be intrusive to building occupants or interfere with vibration-sensitive equipment.

Table 1 summarizes the FTA impact criteria for ground-borne vibration and ground-borne noise. These criteria are based on previous standards, criteria, and design goals, including ANSI S3.29 and the noise and vibration guidelines of the American Public Transit Association. Land use categories are described below.

The FTA assigns sensitive land uses to the following three categories:

- Vibration Category 1: High Sensitivity – Buildings where low ambient vibration is essential for the interior operations in the building. Vibration levels may be below the level of human perception.
- Vibration Category 2: Residential – Residences and buildings where people normally sleep. This includes private dwellings, hospitals and hotels where nighttime sensitivity is assumed to be of utmost importance. It is common practice to also use this category as a standard for some special uses such as auditoriums or theaters.
- Vibration Category 3: Institutional – Land uses with primarily daytime use including schools, churches, other institutions and quiet offices that do not have vibration-sensitive equipment.

As shown in Table 1, some land use activities are more sensitive to vibration than others. For example, residences and buildings where people normally sleep are more sensitive to vibration than institutional land uses with primarily daytime use.

Table 1. FTA Vibration Impact Criteria for Occasional Events		
FTA Vibration Category	**Category Comment**	**Ground-borne Vibration[1] (VdB re 1 micro in/sec)**
1	Low interior vibration is essential	65
2	Residential & sleep	75
3	Institutional & daytime	78

Source: FTA, 2006.

1. Occasional is defined as between 30 and 70 events per day.

4.3. Local Noise Control and Construction Noise Ordinances

Noise analysis for high capacity transportation projects funded by the FTA must be performed in accordance with the FTA guidelines found in the FTA Manual (2006). The FTA guidelines set forth the governing noise impact criteria for any such analysis, and consequently, the project must meet the criteria defined in the FTA guidance. Construction noise and noise from ancillary facilities, such as park and ride lots and maintenance facilities are governed by the applicable state, city and local noise ordinances.

In the case of the proposed project, the regulations from the City of Tacoma would be applicable to the construction of the project, and therefore, are considered in this analysis. The project has no ancillary facilities, and therefore the only local noise control ordinance restrictions would be related to project construction.

The City of Tacoma Municipal Code was examined for any noise ordinances or regulations that may be applicable to this project. Chapter 8.122 of the Tacoma Municipal Code would apply to the construction of the proposed project. Under Sections 8.122.080.D and 8.122.090 of Chapter 8.122, sounds originating from construction work and construction devices are exempt from regulation under Section 8.122.080 of that Chapter between the hours of 7:00 a.m. and 9:00 p.m. during the week and 9:00 a.m. and 9:00 p.m. on the weekend. Work done outside of these hours must comply with the general prohibitions set forth in Chapter 8.122, which effectively means that the contractor would be required to obtain a noise variance from the governing jurisdiction.

There are no other city or county noise regulations that are applicable to construction of the project.

4.4. Construction Vibration Guidelines

There are no specific construction related vibration regulations or criteria. The U.S. Department of Transportation (U.S. DOT) has guidelines for vibration levels from construction related to their activities, and recommends that the maximum peak-particle-velocity levels remain below 0.05 inches per second at the nearest structures. Vibration levels above 0.5 inches per second have the potential to cause architectural damage to normal dwellings. The U.S. DOT also states that vibration levels above 0.015 inches per second are sometimes perceptible to people, and the level at which vibration becomes annoying to people is 0.64 inches per second.

5. Noise and Vibration Impact Assessment Approach

This section provides a summary of the analysis approach and criteria for the noise and vibration analysis. Included are the general modeling input parameters, assumptions and other data used to predict noise and vibration levels from rail operations in the corridor.

There are several different train types that will be using the new bridge on a regular basis. This includes the Sound Transit commuter trains along with Amtrak regional and intercity passenger rail trains. General information on the train types that will travel through this corridor are provided in Table 2 for reference. The table incudes the train name, types of locomotives and types and number of cars that are expected to be used on a typical route.

Table 2. Train Sets In-Use and Planned along the Trestle

Owner/ Train Name	Locomotives	Cars	Notes
Sound Transit Sounder	EMD F59PHI Motive Power MP40PH-3C	Bombardier Multi-Level Cars	Sound Transit Typically runs 7 car trains on the Sounder Line
Amtrak Cascades	EMD F59PHI diesel locomotive EMD F40PH locomotive used as non-powered control units	Talgo articulated tilting train sets	Typically 12 cars depending on demand Push-pull configuration
Amtrak Coast Starlight	GE P42DC diesel locomotive	Superliner Budd Company Hi-Level Pacific Parlour Heritage car	Typically up to 11 to 14 cars on demand
Miscellaneous Freight Trains	Miscellaneous general purpose and switching locomotives	Varies with job	Only occurs infrequently and is not considered to be a measureable contribution to the overall noise in the study area

5.1. Operational Noise Analysis

Noise from rail operations was modeled using the methods described in the FTA, 2006. The FTA methods calculate the total noise from rail operations using reference noise levels for the train locomotives, rail cars, horns and crossing bells and ancillary facilities with corrections for special track type, speed, and schedule. Plan and profile of the proposed rail alignment, including the locations of special trackwork, such as crossovers, and typical speeds, were obtained from project design engineers.

Potential noise impacts related to the Tacoma Trestle Project were determined using the following approach:

1. Perform land use survey of potential noise-sensitive receptors near the proposed trestle. This process involved a site visit and the utilization of area land-use maps. Because of the limited number of noise sensitive properties in this corridor, each was evaluated individually.
2. Establish existing noise levels for the potentially affected area with long-term and short-term noise monitoring and noise level corrections to account for planned and permitted projects.

Ambient noise monitoring was taken at six locations along the corridor. The criteria for monitoring location selection included land use, existing ambient noise, number of sensitive receivers in the area, and level of expected impact. The data was then corrected to account for the added traffic from the approved Amtrak and Sounder rail traffic along this corridor.

3. Use the data from Task 2 to establish the existing conditions noise levels for the noise-sensitive receptors and to obtain the FTA noise impact criteria from Figure 5.
4. Calculate future noise levels using the FTA methods, which is based on track type, train speed, train type, and distance of receiver from tracks, with adjustments for shielding and ground attenuation.
5. Evaluate projections with respect to impact thresholds to determine if the receiver would meet or exceed the FTA criteria.
6. Where noise impacts are identified, consider noise mitigation following Sound Transit Noise Mitigation Policy.

The analysis assumed that all at-grade tracks would be standard ballast and tie type, while the track type on the elevated structure would be direct fixation, with the track attached to concrete plinths located along the structure. The speed of the trains used in the analysis through the area where the homes are located, east of J Street, was 35 mph. For the Best Western Hotel, just south of the Freighthouse Square Station, a speed of 20 mph was used. In the latter case, although the speed used in the analysis is faster than the actual speeds, using faster speeds accounts for the idling noise from the locomotives while loading and unloading at the station.

The train operations used in the noise levels analysis is provided in Table 3. This table provides the level of current service on the existing trestle and the planned and approved projected year 2017 rail traffic. The 2017 rail traffic assumes that the Point Defiance Bypass is completed, and Amtrak trains will share the trestle with the Sound Transit Sounder trains. It also assumes that Sound Transit will implement previously approved plans to increase the Sounder service, adding six new train pass-bys daily. Overall, this results in an increase over the existing 2013 level train traffic by adding 18 daytime trains and four nighttime trains. The increase in the number of trains is not related to the Tacoma Trestle Project and will occur even if the project is not constructed.

Table 3. Train Operation Projections

Train Type	Existing (2013) Daytime Operations	Existing (2013) Nighttime Operations	Year 2017 Daytime Operations	Year 2017 Nighttime Operations
Sound Transit Sounder	15	5	18	8
Amtrak Cascades	0	0	13	1
Amtrak Coast Starlight	0	0	2	0

The changes from the Tacoma Trestle Project that could have an effect on noise and vibration include the location and the speed of the rail traffic on the new trestle. The trestle will have two sets of tracks to allow for two trains to use the trestle simultaneously. For this analysis, it was assumed that all train traffic would be on the tracks nearest to the property under consideration.

As stated in the assumptions, this analysis assumed that the trackway along the at-grade segment, beginning to the west of the East L Street Overpass heading east, would remain ballast and tie track like it

is today. From the eastern trestle abutment to the western abutment at the Freighthouse station, the track type (along the trestle) would be direct fixation, where the tracks are directly fixed to the structure with fasteners over the concrete base. It is important to note that noise from direct fixation track type is slightly louder than what is produced by ballast and tie track type. The lower noise from ballast and tie track type is due to the ballast absorbing some of the noise from the train, whereas the concrete base on the direct fixation track reflects the noise back away from the train. Therefore, if Sound Transit elected to install the track on the elevated structure with ballast and tie, the noise levels at location near the trestle could see reductions of 1 to 2 dB over the noise levels presented in Section 7.

Also, the current speed limit on the trestle is 10 mph, with at-grade speed limits 30 to 35 mph to the east of the trestle. The new trestle would have a speed limit of 35 mph. The increased speeds along the new trestle could increase the noise levels, with a typical increase of 3 dB in noise for each 10 mph increase in speed. However, when the trains are near the homes east of J Street, which are all located along the at-grade segment, the current speeds of the trains are at or near 30 to 35 mph, as recently measured with a radar gun.

5.2. Vibration Assessment Approach

The FTA manual, 2006 describes three different methods for predicting vibration levels near rail systems;

1. Screening Procedure: This procedure is for projects with little or no possibility of creating vibration impacts.
2. General Assessment: The General Assessment is an extension of the screening procedure, with more detailed projections based on historical data and projections.
3. Detailed Assessment: The Detailed Analysis applies all vibration related tools for an accurate projection of vibration levels for projects where vibration impacts are likely and vibration mitigation will likely be required.

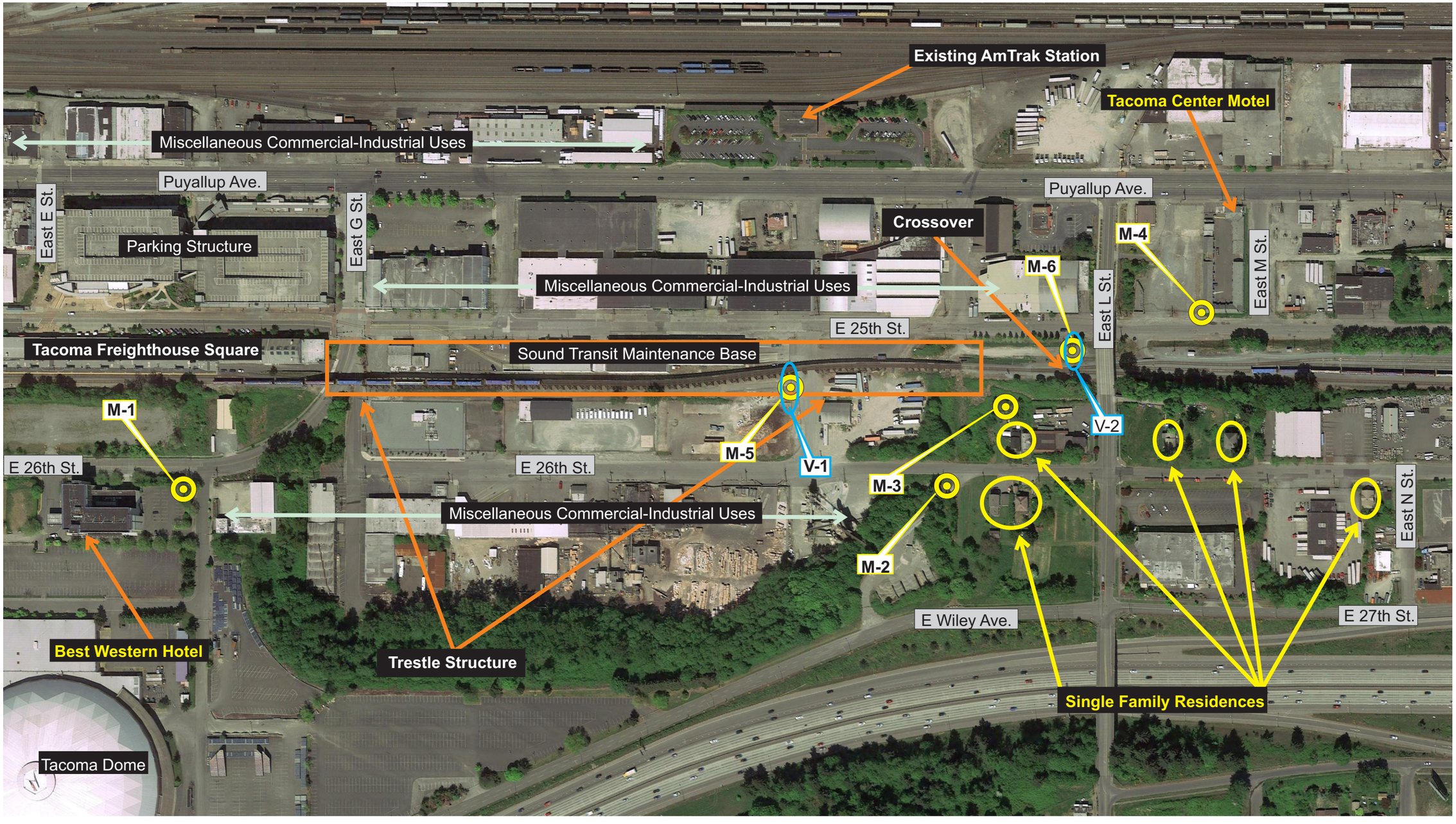
For the Tacoma Trestle Project, the FTA General Assessment methodology with supplemental on-site vibration measurements was selected. The supplemental on-site vibration measurements were taken to verify typical vibration propagation characteristics used by the FTA, and to assist in predicting the added vibration from a crossover near the East L Street overpass. This method assures more accurate vibration projections from rail operations and also provides the data needed for detailed vibration mitigation design if impacts are identified.

As identified, a crossover is located near the East L Street overpass. A track crossover is a mechanical device that enables the trains to be guided from one track to another at a junction point. Crossovers have a gap in the rails that is necessary for the flange of the train wheels to pass through the location where the two tracks cross. As a train wheel passes through the gap there is a potential for increased levels of vibration. According to the FTA manual, standard frogs can increase vibration levels by as much as 10 VdB.

To verify the FTA predicted vibration level, and to obtain an accurate projection of the vibration levels near the crossover, vibration monitoring of the existing Sounder Commuter trains was performed near the East L Street crossover. A second vibration measurement was also taken near the base of the existing trestle structure to obtain a measure of the affect the structure would have on the transmission of vibration in to the ground. Details on both measurements are provided in the next section.

6. Noise and Vibration Measurements

This section provides a summary of the noise and vibration measurements taken as part of the analysis for this project. Noise measurements were performed at six sites along the corridor, and vibration measurements were performed at two sites. The data was used in the impact analysis as specified by the FTA. Noise and vibration monitoring sites, along with noise and vibration sensitive land use within 500 feet of the trestle structure are shown on Figure 6. Details on the noise and vibration monitoring sessions are provide below.



Noise Monitoring Site

Vibration Testing Site

Best Western Hotel = Residential Land Uses

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Portland, Oregon

0 125 250 500

1.00 in

Approximate Scale 1 inch to 250 feet
(11 x 17 inch format)

N

Figure 6
Noise and Vibration Monitoring Locations
Project Area Land Use
Tacoma Trestle Project

6.1. Noise Measurements

Ambient noise monitoring was performed at six locations for the Tacoma Trestle Project. Three of the sites were short-term (30 minutes), one was a long-term (48 hours), and two were used to measure a pass-by of the existing Sounder Commuter trains during normal operation. The monitoring data provide representative noise levels for all noise sensitive uses in this corridor. All noise level measurements were taken between November 22, 2013 and November 25, 2013.

All noise measurements were taken in accordance with the requirements provided by the FTA, 2006. The equipment used for noise monitoring included Bruel & Kjaer Type 2238 and 2250 Sound Level Analyzers. The meters were calibrated prior to, and after the measurement period using a Bruel & Kjaer Type 4231 Sound Level Calibrator. Calibration varied by less than 0.1 dB during the measurement period. Complete system calibration is performed on an annual basis by Bruel & Kjaer Instruments. System calibration is traceable to the National Institute of Standards and Testing (NIST). All measurements system meets or exceeds the requirements for an ANSI Type 1 noise measurement system.

The long-term measurement location, site M-3, was used to obtain an L_{dn} for the four single-family residences located just south of the commuter rail track way, just east of the trestle. The meter was located in the back yard of the residence at 1109 E 26th Street, between the tracks and the home. This home and the one next door to the east are the closest residences to the crossover. The weekday Ldn was measured at 65 dBA, with peak hour noise levels of 62 dBA Leq. Dominant noise sources at these residences included the Sounder Commuter Trains, freight train activity in the rail yards to the north, traffic on Interstate 5, Puyallup Avenue and other arterial roadways along with miscellaneous commercial and industrial activities, such as the concrete batch plant at E J Street and E 26th Street. Noise monitoring at all other sites was performed using short-term measurements. Because short-term measurements were used, some assumptions had to be made to determine the Ldn for these sites. According the FTA, the Ldn can be predicted using a rather simple assumption as follows (see Appendix D-4 in the FTA Noise and Vibration Manual):

- Ldn = Leq - 2 dB for daytime measurements (7:00 am to 7:00 pm)
- Ldn = Leq + 3, for evening measurements (7:00 pm to10:00 pm)
- Ldn = Leq + 8 for nighttime measurements (10:00 pm to7:00 am)

While the method is fine for most residential areas, it is not necessarily accurate in those areas with high levels of nighttime noise. For areas with high levels of nighttime noise, or noise levels that are often equal to or greater than the daytime noise levels, the Ldn will often be 1 to 3 dB, or more, higher than the peak hour Leq. The Tacoma Trestle site is a good example of this scenario. The Leq from the long term site M-3 was 62 dBA Leq, while the measured Ldn at this same site was 65 dBA Ldn, or 3 dB higher than the Leq. The higher Ldn noise level in this area is due, in part, to noise from the heavy rail switching yard operations south of Puyallup Avenue, where nighttime operations are normal, in addition to noise from I-5 and other heavy industrial activities in this area, many which occur during the night. Based on this fact, and a review of the data, the Ldn for the other nearby sites were predicted based on shielding and distance from the switching yard, I-5 and other noise sources.

The first short-term noise monitoring site, M-1, was at the Best Western Hotel located at 2611 East E Street, just north of the Tacoma Dome and south of Freighthouse Square. Noise sources at this site also included traffic on Interstate 5 and other arterial roadways, along with miscellaneous commercial and industrial activities. The Ldn and peak hour Leq were both 68 dBA due to traffic on I-5 and nearby industrial sources.

The other two noise monitoring sites near residential uses includes site M-2, located at the intersection of East K Street and East 26th St, and site M-4, located on the south side (track side) of the Tacoma Center

Motel. These sites both have predicted Ldn levels of 66 dBA and typical daytime Leq noise levels of 64 dBA. Noise sources at both sites include Sounder Commuter Trains, freight train activity in the rail yards to the north, traffic on Interstate 5, Puyallup Avenue and other arterial roadways along with miscellaneous commercial and industrial activities.

Short-term ambient noise levels readings were also take at sites M-5 and M-6, which were used primarily for train pass-by measurements. During periods with no train activity, the typical Leq at both sites was 64 dBA Leq. Noise sources at these sites included traffic along with miscellaneous commercial and industrial activities.

When the background noise level measurements in Table 4 were taken, only 20 of the 42 trains that are scheduled to use this alignment were present. The measurements did not include train traffic from the Amtrak Cascades and Coast Starlight and only included 20 of Sound Transit's 26 daily Sounder trains. Because the FTA noise criteria is based on the existing environment, it was necessary to correct the noise levels in Table 4 to reflect the actual number of daily trains using this corridor. This was accomplished by adding an extra 18 daytime trains and four nighttime trains to the measured data in Table 4 to arrive at the corrected existing conditions noise levels. These corrected noise levels were then used to predict ambient noise levels at nearby noise sensitive properties and establish the FTA impact criteria at each location. The additional train operations increase the Ldn by approximately 1 dB at all sites, however, the peak hour Leq, which included four trains per hour, remained the same because of noise from other sources, including I-5, Puyallup Avenue and local industrial noise sources. Table 4 provides a summary of the correct ambient noise levels use in the noise analysis.

Table 4. Noise Monitoring Summary

Monitoring Location[1]	Site Address	Land Use Type[2]	Type of Measurement[3]	Peak Hour Leq (dBA)	Weekday Ldn (dBA)[4]
M-1	Best Western Hotel, 2611 East E Street, northeast corner facing toward Freighthouse Square	Hotel	Short-term	68	69
M-2	Public ROW at intersection of E K St. and E 26th St, near single family residence at 1106 E 26TH ST.	SFR	Short-term	64	67
M-3	Single Family Residence, 1109 E 26th St, back yard facing toward tracks	SFR	Long-term	62	66
M-4	Tacoma Center Motel, Public ROW on E 25th St, behind hotel facing tracks	Hotel	Short-term	64	67
M-5	E J Street for pass-by test on structure	Industrial	Short-term	64	N/A[5]
M-6	Near E L Street overpass for pass-by testing and crossover noise	Industrial	Short-term	64	N/A[5]

Notes:
1. Noise monitoring sites shown in Figure 6.
2. Land Use: SFR = single-family residence
3. Noise measurements were taken between November 22 and 25, 2013.
4. The Ldn at short-term sites is projected using the methods in the FTA manual and long term data from site M-3 with corrections for 18 daytime trains and four nighttime trains
5. Ldn is not used for industrial sites. Sites M-5 and M-6 were used to verify train pass-by noise levels

6.1.1. Pass-By Noise Measurements

The pass-by noise levels at sites M-5 and M-6 verified the reference data provided by the FTA. The at-grade pass-by noise level of 83 to 84 dBA Lmax and the SEL of 91 dBA are both 1 to 2 dB lower than the data provided by the FTA. The measurement from the existing trestle also agreed with the typical +4 dB correction factor used by the FTA for train traffic on an elevated guideway. Based on these measurements, using the default data provided by the FTA would be expected to produce noise levels 1 to 2 dBA higher than those measured, providing for a conservative noise analysis while also providing a buffer for slight changes in speed or the condition of the train wheels.

6.2. Vibration Measurements

An important factor in projecting levels of vibration related to transit operations is the rate at which the vibration reduces as it propagates away from the source. Measurements were taken at two locations, V-1 located along the existing trestle on East J Street, and at V-2, at grade near an existing crossover west of the East L Street overpass. The speeds of the train as it passes was measured and used to normalize the data to 50 mph. For the at-grade measurements, the average maximum vibration level of 80 VdB agreed with the FTA projection for a typical locomotive powered passenger train traveling at 30 mph.

The measured vibration level from commuter train operations on the elevated structure at a distance of 25 feet from a support pillar was below 72 VdB above 6.3 Hz. Because the vibration criteria occasional events is 75 VdB, no vibration impacts would be projected for structures that are more than 25 feet from the existing elevated structure. The lower levels are due to the vibration being partially absorbed by the timber structure.

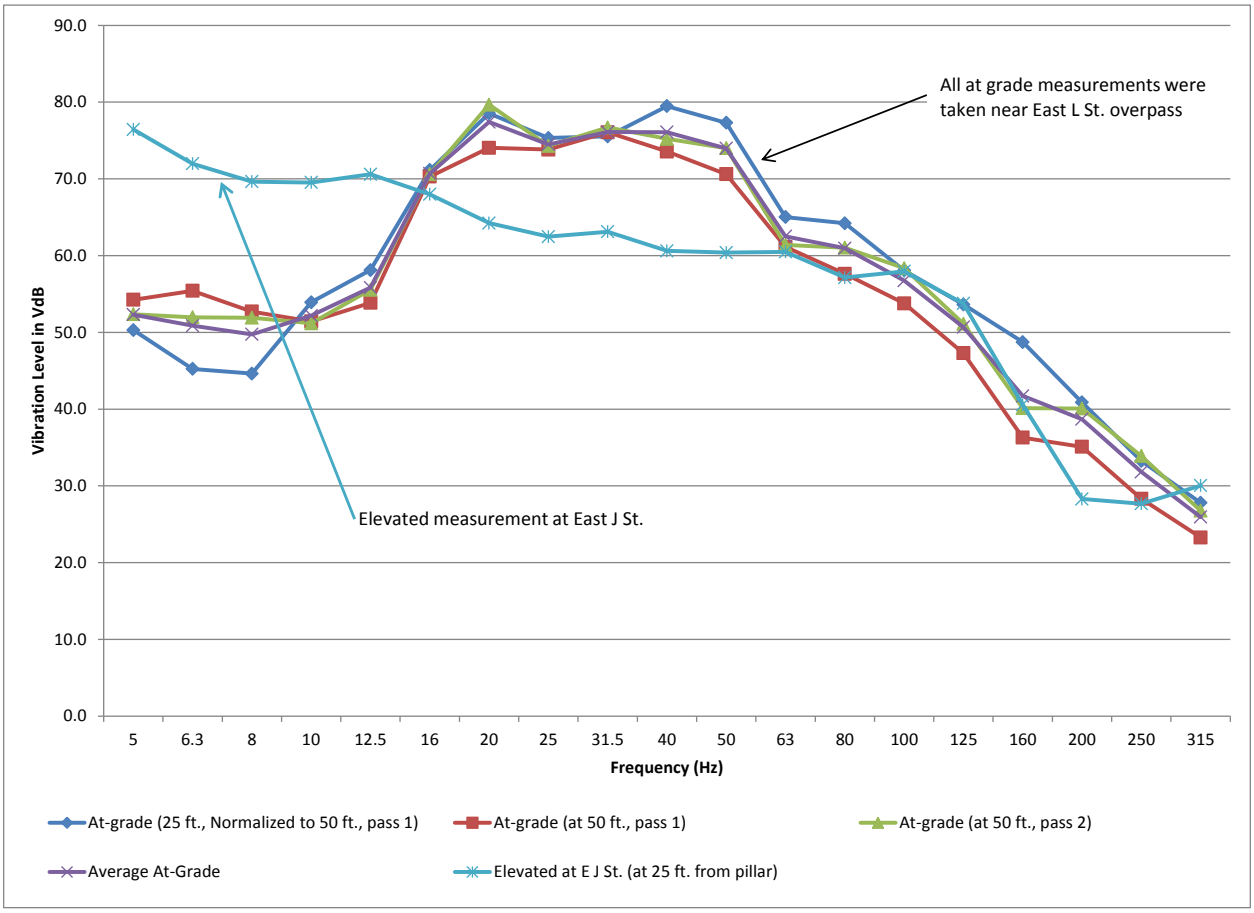
Table 5 provides a summary of the composite measured vibration levels and Figure 7 provides a graph of the at-grade and elevated measurements from the Sounder Trains along the existing at-grade and elevated alignment between East L Street and the Tacoma Freighthouse Square. The distance for the at-grade measurements are normalized to 50 feet, while the elevated measurement was taken at 25 feet from a support pillar. Note that the measurements at the East L Street site also include the added vibration from the nearby crossover.

Table 5. Vibration Measurement Summary

Measurement Location[1]	Site Address	Composite Vibration Level at 25 feet	Composite Vibration Level at 50 feet
V-1	E J Street for pass-by test on structure	80.3 VdB	N/A[3]
V-2	Near E L Street overpass for pass-by testing and crossover noise	84.8 VdB	82.6 VdB

Notes:
1. Noise monitoring sites shown in Figure 6.
2. Vibration measurements were taken on November 22, 2013.
3. There was no measurement at 50 feet near the trestle due to industrial activities

Figure 7. Vibration Measurements from Sounder Train

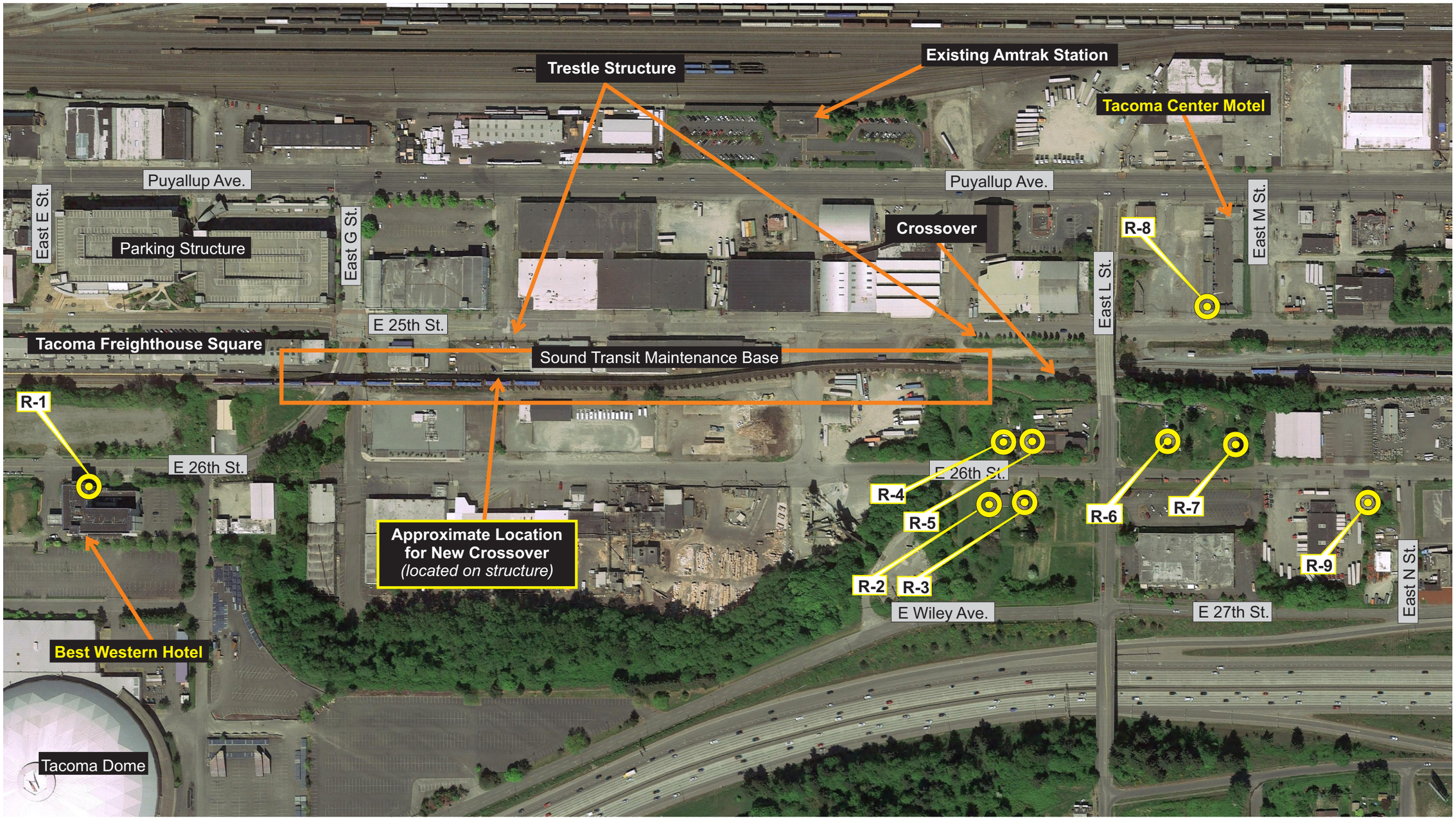


7. Noise and Vibration Impact Analysis

Noise and vibration levels were predicted at nine noise and vibration sensitive properties along the corridor. The analysis area extended from the Tacoma Freighthouse Square to East N Street. This analysis area is actually slightly larger than the planned project work zone, and includes all residential uses within 500 feet of the track alignment between East N Street and the Tacoma Freighthouse Square.

As part of the project a new crossover will be located along the elevated structure near McKinley Avenue E. This new crossover is in addition to the existing crossovers that are located at-grade near the East L Street overpass, and will allow trains to switch tracks just east of the Freighthouse Station. The new crossover is located over 500 feet from any residential uses, including the Best Western Hotel, and therefore did not contribute a notable amount to the overall noise from train operations. Land use near the trestle where the crossover is located is heavy industrial and no vibration related issues are predicted to occur based on the crossover location.

Sites where noise and vibration levels were projected are shown on Figure 8. The figure also includes at the location of the new crossover, existing crossovers and several other structures for reference. Details and complete results are provided in the following two sections.



Noise and Vibration Modeling Sites

Noise and Vibration Modeling Sites with Impacts

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Sound.Vibration.Air
Portland, Oregon

0 125 250 500
1.00 in

Approximate Scale 1 inch to 250 feet
(11 x 17 inch format)

N

Figure 8
Noise and Vibration Modeling Locations
Tacoma Trestle Project

7.1. Operational Noise Level Projections

Evaluation of the environmental noise effects of the Tacoma Trestle Project was based upon the change in the environmental noise level due to the proposed alternative and the dwelling units potentially affected by project noise. The corridor was examined and no Category 1 or 3 land uses were identified, but there are several Category 2 uses near the proposed alignment. The analysis was performed for nine noise sensitive units (single-family residences and hotel rooms) within 500 feet of the proposed corridor. This includes 2 hotels, and seven single-family residences.

This analysis method logarithmically adds the existing noise level with the project noise level to arrive at a cumulative, or total, noise level at each of the receiver locations (see Section 3.1 for information on summing decibels). Then, the increase in noise levels at each receiver, as related to the project, is calculated by subtracting the existing noise from the cumulative noise. The resulting change in noise level (cumulative minus existing) is compared to the allowable increase under the FTA criteria from Figure 5. Receivers that have an increase in noise levels that are higher than the allowable increase from Figure 5 are considered as having a noise impact under the FTA criteria. The results of the noise analysis are provided in Table 6.

Table 6. Operational Noise Impact Analysis (Exterior for R-1 – R-9)

Rec[1]	Description/ Address *Parcel Number*[2]	Existing Noise (L_{dn})[3]	Project Noise (Ldn)[4]	Cumulative Noise Level (existing plus change)	Change in Noise Level (Cumulative minus existing)	FTA Allowable Increase Criteria[5]		FTA Noise Impacts[6]	
						Mod	Sev	Mod	Sev
R-1	2611 E E St. (Hotel) *2076240011*	69	54.8	69.2	0.2	1.1	3	0	0
R-2	1106 E 26th St. (SFR) *2076360020*	67	55.0	67.3	0.3	1.2	3	0	0
R-3	1112 E 26th St. (SFR) *2076360030*	67	55.0	67.3	0.3	1.2	3	0	0
R-4	1109 E 26th St. (SFR) *2076350031*	66	59.5	66.9	0.9	1.3	4	0	0
R-5	1111 E 26th St. (SFR) *2076350040*	66	59.5	66.9	0.9	1.3	4	0	0
R-6	1211 E 26th St. (SFR) *2076370030*	66	59.7	66.9	0.9	1.3	4	0	0
R-7	1221 E 26th St. (SFR) *2076370030*	66	59.7	66.9	0.9	1.3	4	0	0
R-8	1220 Puyallup Ave (Motel) *2076370030*	67	59.7	67.7	0.7	1.2	3	0	0
R-9	1320 E 26th St. (SFR) *4715010850*	67	55.2	67.3	0.3	1.2	3	0	0

Notes:
1. Receiver locations are shown in Figure 8
2. County parcel numbers
3. Existing area noise level in L_{dn}
4. Increase in noise from speed change for Sounder and Amtrak operations
5. FTA noise impacts criteria based on change in existing noise levels
6. Predicted number of homes or rooms with noise impacts; Mod = FTA Moderate Impacts; Sev = FTA Severe Impacts

As is shown in the Table 6, there are no receivers where the project noise level meet, or exceed, the FTA criteria based on the existing ambient noise levels and cumulative noise levels. Project noise levels at the Best Western Hotel are lower due to the distance from the tracks to the hotel and slower speeds of trains at the Freighthouse station. For the single-family residences, project noise levels ranged from 55.0 to 59.7

dBA Ldn, while the Tacoma Center Motel also has a predicted project related Ldn of 59.7 dBA. The results are increases in the cumulative noise levels ranging from 0.2 dB at the Best Western (R-1) to 0.9 dB at several of the single family residences (R-4 through R-7). The noise level increase is due to the increased speed of the train as it approaches and departs from the new trestle.

7.2. Vibration

Using the methods described above, vibration predictions were made for all nine vibration sensitive properties along the corridor. The distance to the nearest column is the most important factor in determining vibration impact from the elevated structure. To determine project related vibration levels at each sensitive receiver, the distance from each of the residential structures to the nearest track or nearest structure column, which ever was less, was measured and used to predict the vibration levels. Table 7 shows a list of receivers, measured distance, predicted vibration levels and whether impact is predicted for that receiver.

Table 7. Vibration Impact Assessment

Rec #[1]	Description	Closest Distance to Structure[2]	Vibration Criteria[3]	Maximum 1/3 Octave Exterior Vibration Levels	Vibration Impact[4]
R-1	2611 E E St. (Hotel)	244	75 VdB	58.3 VdB[5]	0
R-2	1106 E 26th St. (SFR)	303	75 VdB	64.4 VdB	0
R-3	1112 E 26th St. (SFR)	313	75 VdB	64.1 VdB	0
R-4	1109 E 26th St. (SFR)	148	75 VdB	70.6 VdB	0
R-5	1111 E 26th St. (SFR)	150	75 VdB	70.5 VdB	0
R-6	1211 E 26th St. (SFR)	145	75 VdB	70.8 VdB	0
R-7	1221 E 26th St. (SFR)	136	75 VdB	71.3 VdB	0
R-8	1220 Puyallup Ave (Motel)	125	75 VdB	72.0 VdB	0
R-9	1320 E 26th St. (SFR)	290	75 VdB	65.7 VdB	0

Notes:
1. Receiver locations are shown in Figure 8
2. Distance from nearest trackway/column to the analysis structure in feet
3. FTA vibration impact criteria
4. Structures identified with vibration impacts
5. Vibration levels at R-1 are lower due to the slower speed at the station

The data in Table 7 show that all sensitive land uses in the corridor will be below the FTA vibration criteria for occasional events of 75 VdB. As with noise, the lower vibration levels at site R-1 is due to the slower speeds at the station. All other sites are at a sufficient distance that the vibration from the train operations are absorbed by the strata and no vibration impacts are predicted.

Vibration levels for business at the Freighthouse Square station building would be expected to be below 78 to 80 VdB due to the slower speeds of trains at the station (the analysis assumed a speed of 20 mph at the station). Although business at this site would not be considered to be vibration sensitive due to the location, vibration levels of this magnitude are compatible with most business operations. No vibration impacts are projected.

8. Operational Noise and Vibration Mitigation

Because there are no noise or vibration impacts predicted, no noise or vibration mitigation is proposed. Sound Transit is committed to maintaining all of their commuter trains in good operating condition. This includes maintain the wheels, engine shrouds and other equipment on the vehicles associated with noise and vibration. Amtrak also has a maintenance program to maintain the Cascades and Coast Starlight trains in good operating conditions. These maintenance programs help to assure that the noise and vibration levels from commuter and interstate train operations will be kept to a minimum. Based on this fact, and the lack of noise or vibration impacts, no other noise or vibration mitigation is necessary for operations along this corridor within the FTA criteria.

9. Construction Noise and Vibration

This construction noise and vibration analysis considers the temporary effects that construction would cause in the project area. These effects would end when project construction is completed.

9.1. Construction Noise

Equipment required to complete the project includes normal construction equipment that is used for many roadway and structural construction projects. Table 8 provides a typical list of the types of equipment used for this type of project, the activities they would be used for, and the corresponding maximum noise level as measured at 50 feet, under normal use.

Table 8. Construction Equipment List, Use, and Maximum Noise Levels

Equipment	Typical Expected Project Use[1]	Typical Noise Level at 50 feet in dBA[2]
Air Compressors	Used for pneumatic tools and general maintenance	81
Backhoe	General construction and yard work	80
Concrete Pump	Pumping concrete	82
Concrete Saws	Concrete removal, utilities access	75 – 80
Crane	Materials handling, removal and replacement,	83 – 88
Excavator	General construction and materials handling	82 – 88
Fork Lifts	Staging area and materials handling	72
Generators	Lighting and staging area	78 – 81
Haul Trucks	Materials handling, general hauling	86 – 88
Jack Hammers	Pavement removal	88
Loader	General construction and materials handling	85
Pumps	General construction use, water removal	76
Pneumatic Tools	Miscellaneous construction work	85
Service Trucks	Repair and maintenance of equipment	72
Tractor Trailers	Material removal and delivery	82 – 86
Utility Trucks	General project work	72
Vibratory equipment	Soil compacting	82 – 88
Welders	General project work, track welds	76

Notes:
1. Typical project uses
2. Typical maximum noise level under normal operation as measured at 50 feet from the noise source, FTA 2006

Several construction phases would be required to complete the Tacoma Trestle Project. The analysis assumes the worst-case noise levels based on three major types of construction described below and shown in Table 9. The actual noise levels experienced during construction would generally be lower than those given in this report. The noise levels presented here are for short periods of maximum construction activity and would occur for a limited period of time.

Table 9. Noise Levels for Typical Construction Phases

Scenario[b]	Equipment[c]	L_m[a,d]	L_{eq}[a,e]
Demolition and construction preparation	Air compressors, backhoe, concrete pumps, crane, excavator, forklifts, haul trucks, loader, pumps, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment	94 dBA	87 dBA
Structures construction, track installation, and paving activities	Air compressors, backhoe, cement mixers, concrete pumps, crane, forklifts, haul trucks, loader, pavers, power plants, service trucks, tractor trailers, utility trucks, vibratory equipment, welders	94 dBA	88 dBA
Miscellaneous activities	Air compressors, backhoe, crane, forklifts, haul trucks, loader, service trucks, tractor trailers, utility trucks, welders	91 dBA	83 dBA

Notes:
a. Combined worst-case noise levels for all equipment at a distance of 50 feet from work site.
b. Operational conditions under which the noise levels are projected.
c. Normal equipment in operation under the given scenario.
d. L_m (dBA) is an average maximum noise emission for the construction equipment under the given scenario; for this type of equipment and activities, the Lm is slightly less than the Lmax.
e. L_{eq} (dBA) is an energy average noise emission for construction equipment operating under the given scenario.

Major noise-producing equipment used during the construction demolition and preparation stage could include saw cutters, concrete pumps, cranes, excavator, haul trucks, loader, tractor-trailers, and vibratory equipment. Maximum noise levels could reach 82 to 94 dBA at the nearest residences (i.e., within 50 to 100 feet) for normal construction activities during this phase. Other, less notable noise-producing equipment expected during this phase includes backhoes, air compressors, forklifts, pumps, power plants, service trucks, and utility trucks.

The loudest noise sources in use during construction of elevated structures would include cement mixers, concrete pumps, cranes, pavers, haul trucks, and tractor-trailers. The cement mixers, cranes, and concrete pumps would be required for construction of the superstructure. The pavers and haul trucks would be used to provide the final surface on the structures and roadways. Maximum noise levels would range from 82 to 94 dBA at the closest receiver locations.

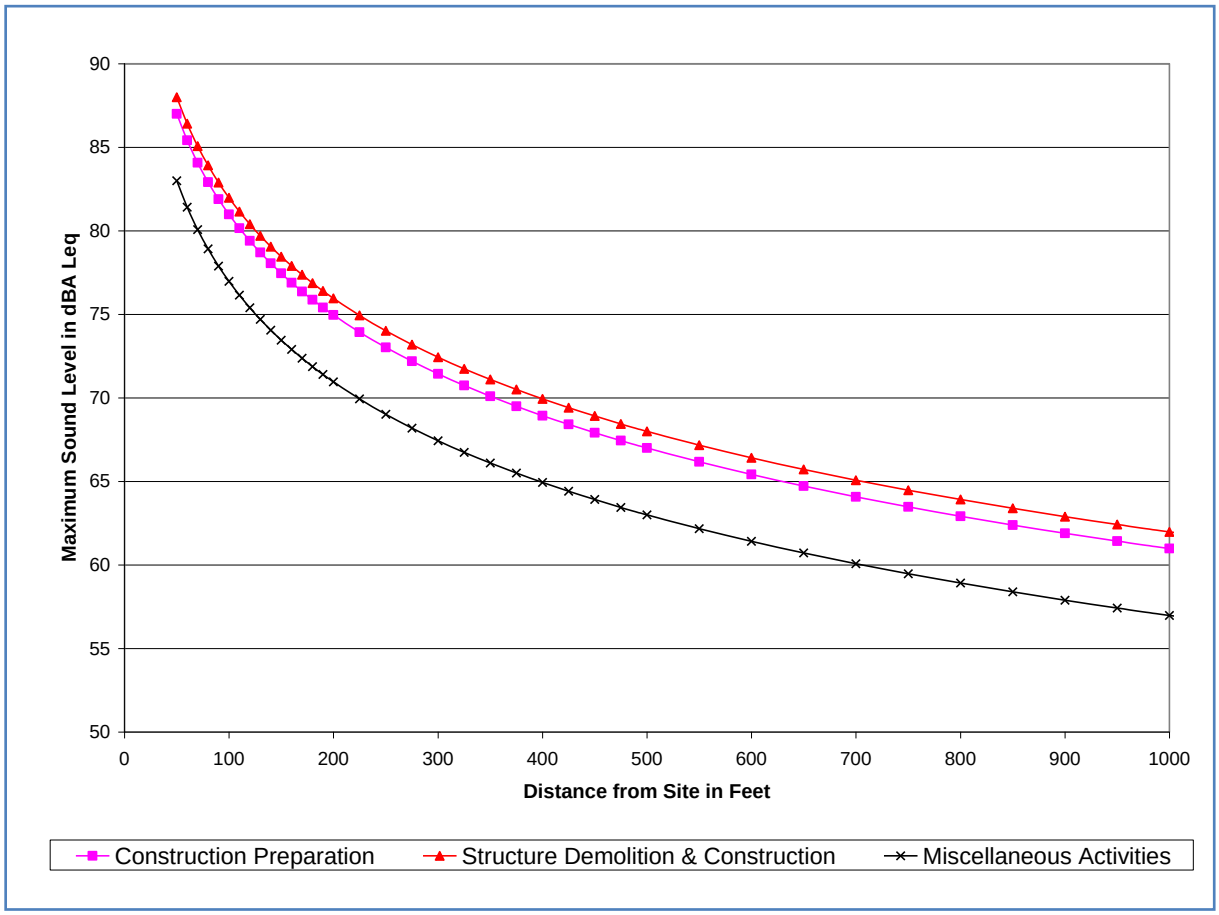
Following the heavy construction, general construction such as installation of railing, signage, communication and other general activities would still need to occur. These less intensive activities are not expected to produce noise levels above 83 dBA at 50 feet except during rare occasions, and even then only for short periods of time.

Using the information in Table 9, typical construction noise levels were projected for several distances from the project work area. Figure 9 is a graph of general construction noise level versus distance for project phases of construction. If construction was performed during hours exempted in the City of Tacoma Code (7:00 am to 9:00 pm on weekdays or 9:00 am to 9:00 pm on weekends, excluding

holidays), the construction noise is exempt from the noise control ordinance. Although construction noise may be disruptive at some nearby properties during heavy periods, the noise levels presented are the worst case noise levels and would only occur for short periods during the project.

Finally, per the city code, construction is prohibited between the hours of 9:00 p.m. and 7:00 a.m. on weekdays or between the hours of 9:00 p.m. and 9:00 a.m. on weekends and federal holidays. Any construction noise during these restricted periods could be no more than 5 dB over the typical ambient noise levels during, which would preclude virtually all construction activities from occurring. If construction was proposed between the hours of 9:00 p.m. and 7:00 a.m. on weekdays or between the hours of 9:00 p.m. and 9:00 a.m. on weekends, a noise variance from the City of Tacoma would be required. Construction noise variances rarely will include any state or federal holidays unless there is an emergency.

Figure 9. Construction Noise Levels by Scenario and Distance



9.1.1. Pile-Driving

If pile-driving was used in construction of the Tacoma Trestle Project, it would need to be performed during daytime hours in order to comply with the City of Tacoma Municipal Code. Maximum noise levels from pile driving are typically 105 dBA or lower.

9.1.2. Nighttime Construction Activities

Given the project corridor, and location of the elevated guideway, it is unlikely that nighttime construction would be required. In order to perform construction at night, a noise variance from the City of Tacoma would be required.

9.2. Construction Vibration

Vibration associated with general construction activities can result in increased vibration levels. Project related vibration sources include excavators, haul trucks, flat bed tractor-trailers, backhoes, cranes and jackhammers. The vibration sources associated with the project, even though are likely to be noticeable to residents when construction is nearby, are not expected to cause any structural damage.

Vibration levels for construction activities are projected to be the highest during demolition activities and soil compacting. Major construction equipment that would be used during demolition includes excavators, haul trucks, backhoes, jackhammers and cranes. Based on information from the U.S. Bureau of Mines, it typically takes vibration levels in excess of 0.5 inches per second (in/sec) to cause cosmetic damage to plaster walls, and 0.75 in/sec for cosmetic damage to drywall. Vibration levels from project construction are projected to remain below 0.5 in/sec at residents along the project corridor due to the distance between the work zones and structures. Based on this, there is only a minimal potential for any structural damage during construction, and only for structures located within 25 to 50 feet from the workzones. Table 10 provides vibration levels for several different common pieces of construction equipment.

Table 10. Vibration Levels for Typical Construction Equipment

Equipment	Conditions	Peak Particle Velocity at 25 feet (in/sec)	Vibration Level in VdB at 25 feet (re 1 micro-in/sec)
Large Bulldozer	Normal operations	0.089	87
Loaded haul trucks	Normal operations	0.076	86
Jackhammer	Normal operations	0.035	79
Small Bulldozer	Normal operations	0.003	58
Vibratory Roller	Normal operations	0.210	94

Source: FTA 2006

9.3. Construction Noise Mitigation

Sound Transit is committed to meeting all applicable standards and regulator requirements during project construction. The project specification shall be written to ensure that all equipment meets state, local, and any manufacturer's specifications for noise emissions. Equipment not meeting the standards could be removed from service until proper repairs can be made, and the equipment re-tested for compliance.

Several construction noise abatement methods, including operational methods, equipment choice, or acoustical treatments, could be implemented to limit the effects of construction noise. The methods used may vary in the project corridor depending on the project's construction criteria.

The following is a list of some typical noise mitigation measures that Sound Transit could include in the contract specifications:

Equipment Noise Mitigation

1. Where possible, use concrete crushers or pavement saws rather than hoe rams for tasks such as concrete deck removal and retaining wall demolition.
2. Ensure that pneumatic impact tools and equipment used at the construction site have intake and exhaust mufflers recommended by the manufacturers thereof, to meet relevant noise ordinance limitations.
3. Construction equipment, both stationary and mobile, should be of recent manufacture and incorporate effective noise-suppression design, including features such as shrouds, baffles, and mufflers or as recommended by the manufacturers. Locate stationary equipment that generates noise away from sensitive receptors and shield with a noise-attenuating barrier or shroud.
4. Line or cover storage bins and chutes with sound-deadening material. Ensure all vehicles engaged in loading on-site have lined truck beds.
5. Provide mufflers or shield paneling for other equipment, including internal combustion engines, recommended by manufacturers thereof.
6. As required to meet the noise limits, use alternative procedures of construction and selection of proper combination of techniques that generate least overall noise and vibration. Such alternative procedures include the following:
    a. Use electric welders powered from utility main lines instead of internal combustion powered generators/welders.
    b. Mix concrete off-site instead of on-site. Note that there is a concrete batch plane located near the site.
    c. Employ prefabricated structures instead of assembling on-site.
    d. Drilled pile installation methods.
7. Use construction equipment manufactured or modified to dampen noise and vibration emissions, such as:
    a. Use electric instead of diesel-powered equipment.
    b. Use hydraulic tools instead of pneumatic impact tools.
    c. Use electric instead of air- or gasoline-driven saws.

Construction Methods Noise Mitigation

1. Operate equipment and in particular slurry wall installation equipment and cranes so as to minimize banging, clattering, buzzing, and other annoying types of noises, especially near residential areas.
2. To the extent feasible, configure the construction site in a manner that keeps noisier equipment and activities as far as possible from noise sensitive locations and nearby buildings.
3. In no case are above restrictions limiting the responsibility for compliance with applicable federal, state and local safety ordinances and regulations.
4. Maximize physical separation, as far as practicable, between noise generators and noise receptors.
5. Minimize noise-intrusive impacts during most noise sensitive hours.
6. Plan noisier operations during times of highest ambient noise levels.
7. Keep noise levels relatively uniform; avoid excessive and impulse noises.
8. Turn off idling equipment.
9. Phase in start-up and shut-down of site equipment.
10. Avoid simultaneous activities that both generate high noise levels.
11. Use construction truck routes for excavation disposal to minimize noise.
12. Conduct truck loading, unloading and hauling operations so noise and vibration are kept to a minimum.

13. Grade surface irregularities on construction sites to minimize the generation of impact noise and ground vibrations by passing vehicles.
14. Use warning broadband backup alarms on all equipment in operation at the site, at all times.
15. Limit the use of annunciators or public address systems, except for emergency notifications.

The contract specifications will contain a section specific to construction related noise and also provide the actual construction noise limits, mitigation measures, and operational methods that will be used to maintain reasonable construction noise levels. The construction specifications will also provide requirements for construction noise monitoring, reporting and any construction log or hotline to be associated with this project.

9.4. Construction Vibration Mitigation

The construction contract specifications could also contain a section specific to vibration that could require vibration monitoring of all activities that may produce vibration levels at or above 100 VdB or 0.5 inch per second whenever there are structures located near the construction activity. This would only be required for construction activities that have the potential to cause high levels of vibration. Vibration effects from construction can be kept to a minimum by restricting and monitoring vibration-producing activities.

10.References

Sound Transit, *Seattle- to-Tacoma Commuter Rail Easements 3 and 4 DCE,* Approved Federal Transit Administration, Washington, D.C., 2012

U.S. Department of Transportation. *Transit Noise and Vibration Impact Assessment*: Federal Transit Administration, Washington, D.C. 2006.

Washington State Department of Transportation, *Noise and Vibration Discipline Report, Point Defiance Bypass Project*, 2012

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Attachment C

Memorandum of Agreement

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MEMORANDUM OF AGREEMENT

AMONG
THE FEDERAL TRANSIT ADMINISTRATION,
WASHINGTON STATE HISTORIC PRESERVATION OFFICER,
AND THE CENTRAL PUGET SOUND REGIONAL TRANSIT AUTHORITY
Implementing
Section 106 of the National Historic Preservation Act

for the

TACOMA TRESTLE TRACK AND SIGNAL PROJECT
IN THE STATE OF WASHINGTON

WHEREAS, the Central Puget Sound Regional Transit Authority (Sound Transit) proposes to construct the Tacoma Trestle Track and Signal project (Project), that will replace the existing single track Tacoma Trestle with a new double track bridge structure and construct related track improvements between East F Street and East M Street in Tacoma, Washington; and

WHEREAS, the Federal Transit Administration (FTA), the responsible Federal agency, is providing federal financial assistance for the Project and as part of its obligation as the grant administrator has determined that the Project is an undertaking, as defined in Title 36 Code of Federal Regulations (CFR) §800.16(y), and thus is subject to review under Section 106 of the National Historic Preservation Act (NHPA), 16 U.S.C. §470 (Section 106) and its implementing regulations, 36 CFR Part 800; and

WHEREAS, Sound Transit is the designated applicant responsible for obtaining the necessary approvals and permits to undertake the Project; and

WHEREAS, FTA and Sound Transit have consulted with the Washington State Historic Preservation Officer (SHPO), interested and affected Indian tribes, and other parties with a demonstrated interest in the effects of the Project on historic properties in accordance with Section 106 of the NHPA (16 USC 4701) and its implementing regulations (36 CFR Parts 800.2 and 800.3); and

WHEREAS, FTA and Sound Transit, in consultation with SHPO, have defined the Project's area of potential effect (APE) as described in Attachment A and conducted cultural resource studies constituting a reasonable and good faith effort to identify historic properties and archaeological resources within the APE pursuant to 36 CFR 800.4; and

WHEREAS, FTA, Sound Transit, and SHPO determined that only one property within the APE, the Tacoma Trestle, is eligible for listing in the National Register of Historic Places (NRHP) under Criteria A and C; and

WHEREAS, existing conditions (e.g., pavement and structures) have restricted access to conduct archaeological investigative testing in certain places; and

WHEREAS, an archaeologist monitored geotechnical investigations for conceptual engineering and observed an isolate determined to be not eligible for the NRHP; and

WHEREAS, FTA and Sound Transit, in consultation with SHPO, have determined that the undertaking will have an adverse effect which results from impacts to the Tacoma Trestle; and

WHEREAS, in accordance with 36 CFR § 800.6, FTA and Sound Transit have consulted with the Puyallup Tribe of Indians, the Nisqually Indian Tribe, and the Confederated Tribes and Bands of the Yakama Nation about the Project and invited them to help identify adverse effects and measures to avoid, minimize or mitigate such effects; to help develop this Agreement; and to concur with this Agreement; and

WHEREAS, in accordance with 36 CFR § 800.6, FTA and Sound Transit have consulted with the Cascade Rail Foundation, the City of Tacoma, Historic Tacoma, the Tacoma Chapter of the National Railway Historical Society, the Steilacoom Tribe (a non-federally recognized tribe), and the Tacoma Historical Society, and invited them to help identify adverse effects and measures to avoid, minimize or mitigate such effects; to help develop this Agreement; and to concur with this Agreement; and

WHEREAS, the Federal Railroad Administration (FRA) is conducting an environmental review of passenger platform improvements for the Point Defiance Bypass project which is independent from the Tacoma Trestle project, but is located in the Project area, and therefore wishes to concur with this Agreement; and

WHEREAS, FTA requires that Sound Transit, the sponsor and owner of the undertaking, participate in the consultation and become a signatory to this Agreement; and

WHEREAS, in accordance with 36 CFR § 800.6(a)(1), FTA has notified the Advisory Council on Historic Preservation (ACHP) of its adverse effect determination with specified documentation and the ACHP has chosen not to participate in the consultation;

NOW, THEREFORE, FTA, SHPO, and Sound Transit agree that the undertaking shall be implemented in accordance with the following stipulations to satisfy FTA's Section 106 responsibilities.

STIPULATIONS

FTA, as the federal agency, is responsible for the implementation of the terms of this Agreement and will require, as a condition of any approval of federal funding for the undertaking, adherence to the stipulations set forth herein. Sound Transit will be primarily responsible for implementing each stipulation unless otherwise noted in the stipulation and will implement all stipulations by employing professionals with expertise, training and experience appropriate to the task.

FTA and Sound Transit shall implement the following terms and conditions in a timely manner and with adequate resources in compliance with the NHPA.

I. TACOMA TRESTLE

The following measures will be undertaken to resolve adverse effects to the Tacoma Trestle:

A. Sound Transit shall prepare Department of Archaeology and Historic Preservation (DAHP) Level II documentation of the Tacoma Trestle prior to its removal. At least one draft of the documentation shall be provided to SHPO for review and comment prior to acceptance. Additional copies of the documentation will be provided to other parties as appropriate; and

B. Sound Transit will coordinate with HistoryLink.org to prepare an essay on the Tacoma Trestle that discusses the history and important characteristics of the trestle. The essay will be available on historylink.org prior to construction; and

C. Sound Transit will use the HistoryLink.org essay or retain a historian to write an article for a railroad publication regarding the history and important characteristics of the Tacoma Trestle. The essay or article will be submitted for consideration within one year of the completion of construction; and

D. Sound Transit will incorporate a Milwaukee Road logo into the new bridge. If the historic logo cannot be reused, Sound Transit, in consultation with the SHPO, will incorporate a new Milwaukee Road logo into the new bridge that will provide the public with a visual reference to the historic logo on the existing Tacoma Trestle. Sound Transit will provide the SHPO and consulting parties with an opportunity to review and comment on the concepts, designs, and plans for the new logo including location on the new bridge. Information which indicates the new bridge was not constructed by the Milwaukee Road, such as a sign noting the operational dates of the Milwaukee Road, will supplement the logo; and

E. Sound Transit will undertake or oversee the design, manufacture, and installation of an interpretive display regarding the history and important characteristics of the Tacoma Trestle. Sound Transit will commit approximately $150,000 for the display. Sound Transit will consult with FTA, SHPO, and consulting parties on the display and will provide SHPO and consulting parties an opportunity to review and comment on the display location, content, and design. The display will be located in a visually prominent location; and

F. Sound Transit will provide SHPO an opportunity to review and comment on the design of the replacement bridge structure.

II. ARCHAEOLOGY

A. An archaeologist who meets the Secretary of the Interior's standards will prepare an archaeological testing plan for preconstruction subsurface archaeological and geotechnical investigations. FTA will transmit the testing plan to SHPO,the Nisqually Indian Tribe, and the Puyallup Tribe of Indians for a 30-day review. The archaeological investigation will target locations that are of higher sensitivity but currently inaccesable due to paved surfaces and depths below the ground surface. The plan shall also include protocols in the event cultural resources are encountered during the preconstruction activities. The results of the preconstruction investigations will be incorporated into the Archaeological Monitoring and Treatment Plan (Section B below).

B. If FTA determines further monitoring is needed, project archaeologists who meet the Secretary of the Interior's professional standards shall prepare an Archaeological Resources Monitoring and Treatment Plan (Monitoring Plan) on behalf of FTA. The Monitoring Plan will guide the actions of the construction team and cultural resources professionals during project implementation. The Monitoring Plan shall be developed in consultation with SHPO, the Nisqually Indian Tribe, and the Puyallup Tribe of Indians, and other consulting parties prior to construction. FTA will transmit the Monitoring Plan to SHPO and affected tribes for a 30-day review. The plan shall:

1. Describe Project actions to clarify the extent of ground disturbing actions and design parameters that could affect archaeological resources, based on a review of the design plans and discussions with Project engineers; and

2. Incorporate information derived during preconstruction activities such as geotechnical investigations; and

3. Develop appropriate levels of archaeological monitoring during construction including incoorperating monitoring procedures in the construction contract documents to be followed by the construction contractors and Project staff; and

4. Describe methods that will be used to recover and process archaeological materials and information that may be evaluated for listing in the NRHP; and

5. Develop an approach to communicate project updates, review of plans, or reporting of fieldwork activities to FTA, SHPO and consulting parties, depending on the nature of the information; and

6. Outline final reporting requirements; and

7. Identify requirements and procedures for final curation of artifacts and information associated with any data recovery actions; and

8. Identify procedures to be followed by the construction contractors and Project staff, which will ensure appropriate consideration of archaeological resources if encountered during construction. It will establish the formal process and notification responsibilities of relevant parties and provide clear authority for stopping work in the event of an inadvertent discovery; and

9. Provide for the treatment of human remains, if discovered. This part will describe actions that shall be taken in the event that human skeletal remains are discovered during construction. It will inform Project personnel about the requirements of implementing the State law relating to the inadvertent discovery of Human Skeletal Remains under RCW 27.44.055 and RCW 68.60.55 and shall comply with ACHP's Policy Statement Regarding Treatment of Burial Sites, Human Remains, and Funerary Objects, and will provide project personnel with a clear understanding of the subsequent process.

III. GENERAL REQUIREMENTS

A. As a condition of any award of any assistance and of its National Environmental Policy Act (NEPA) determination, FTA shall require Sound Transit to carry out the requirements of this Agreement and any applicable laws.

B. Signatories shall keep confidential any sensitive cultural resources information, to the extent allowed by federal and state law.

C. Activities carried out under this Agreement shall meet the Secretary of the Interior's Standards and Guidelines for Historic Preservation (48 FR 44716) as well as SHPO's standards and guidelines for historic preservation activities.

D. FTA shall retain responsibility for complying with all federal requirements pertaining to direct government-to-government consultations with affected tribes. Notwithstanding any other stipulation of this Agreement, FTA shall honor any federally recognized tribe's request for direct consultation regarding the project.

E. At the request of interested tribes, FTA and Sound Transit shall assure access to observe Project archaeological monitoring activities.

IV. DISPUTE RESOLUTION

A. FTA, Sound Transit, and SHPO are signatories to this Agreement and are the parties who are authorized to address and informally resolve disagreements concerning its implementation.

B. If informal resolution cannot be achieved, any signatory to this Agreement may object in writing to FTA or Sound Transit regarding any action carried out or proposed with respect to implementation of this Agreement. The agency receiving objection shall within ten working days initiate consultation with the objecting party to resolve the objection.

C. If after initiating such consultation FTA or Sound Transit determines that the objection cannot be resolved through consultation, FTA shall forward all documentation relevant to the objection to the Advisory Council on Historic Preservation (ACHP), including FTA's proposed response to the objection.

D. Within thirty calendar days after receipt of all pertinent documentation, ACHP shall exercise one of the following options:

1. Advise FTA that ACHP concurs with the FTA's proposed response to the objections, whereupon FTA will respond to the objection accordingly; or

2. Provide FTA with recommendations, which FTA shall take into account in reaching a final decision regarding its response to the objection; or

3. Notify FTA that the objection will be referred for comment pursuant to 36 CFR §800.7(a) (4), and proceed to refer the objection and comment.

E. FTA shall take the resulting comment into account in accordance with 36 CFR §800.7(c)(4), with reference only to the subject of the specified dispute. FTA's responsibility to ensure that all actions under this Agreement that are not the subjects of the dispute are carried out will remain unchanged.

F. All signatory and concurring parties to this Agreement commit to acting in good faith to carry out its commitments and to resolve any disputes related to its implementation.

V. AMENDMENT AND TERMINATION

A. FTA, Sound Transit, and SHPO are signatories to this Agreement and are the parties who are authorized to terminate it by providing 30 calendar days written notice to the other parties. If requested by a signatory, the signatories may meet during the period prior to termination to seek agreement on amendments or other actions that would avoid termination.

B. In the event of termination, FTA shall comply with 36 CFR 800 with regard to all remaining actions under this Agreement.

C. This MOA may be amended when such an amendment is agreed to in writing by all signatories. The amendment will be effective on the date a copy signed by all of the signatories is filed with ACHP.

VI. CONSULTATION UNDER SECTION 106

A. FTA notified the ACHP of an adverse effect of the Project on properties listed in or eligible for listing in NRHP, affording ACHP an opportunity to comment and/or participate in resolving adverse effects. ACHP has declined to participate in the consultation to resolve adverse effects. The executed MOA will be filed with ACHP, pursuant to 36 CFR 800.6(b)(I)(iv).

B. Execution and implementation of this Agreement is evidence that FTA and Sound Transit have taken into account the effects of the Project on historic properties and afforded the ACHP an opportunity to comment on those effects, and is evidence that FTA and Sound Transit have complied with the consultation requirements under Section 106.

VII. EXECUTION

A. Unless terminated, the MOA shall remain in effect from the date of execution until 5 years after construction is completed or earlier if FTA has determined and SHPO has concurred that the terms of this MOA have been satisfactorily fulfilled. Upon such determination, this MOA shall terminate, and FTA shall provide SHPO with written notice of the determination and termination.

B. The undersigned official representatives of the parties affirm and concur with the Agreement and enter into this Agreement on behalf of their respective parties. Each party represents that the person executing this Agreement on its behalf is duly authorized to execute this Agreement.

VIII. MISCELLANEOUS

This MOA creates no right of action for any signatory to this Agreement or any other party.

SIGNATORIES:

Federal Transit Administration

R.F. Krochalis, Regional Administrator — Date: 4/11/14

Washington State Department of Archaeology and Historic Preservation

Allyson Brooks, Ph.D., State Historic Preservation Officer — Date: 4/14/14

Sound Transit

Joni Earl, Chief Executive Officer — Date: 4/9/14

CONCUR:

Cascade Rail Foundation

Paul Krueger
Paul Krueger, Secretary

April 29, 2014
Date

Tacoma Trestle Track and Signal Project
Memorandum of Agreement, Concurring Party Signatures

CONCUR:

Historic Tacoma

Gary Knudson, President

Date 4/17/14

Tacoma Trestle Track and Signal Project
Memorandum of Agreement, Concurring Party Signatures

CONCUR:

Federal Railroad Administration

David A. Valenstein, Division Chief
Environment and Systems Planning
Office of Passenger and Freight Programs

4/24/14
Date

ATTACHMENT A

Tacoma Trestle Track and Signal Area of Potential Effect

Consistent with 36 CFR § 800.16(d), the area of potential effect (APE) includes "the geographic area or areas within which the undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist." The APE for the Tacoma Trestle project includes the railroad right-of-way and extends to the adjacent buildings located between East 25th Street and East 26th Street (see Figure 1).

Figure 1. APE Map